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The Physiotherapy Review

Volume 17 Number 1

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Medical Factors

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Birth Injuries

Winthrop Morgan Phelps, M. D.

More than fifty years ago, Little described what has since been known as Little's Disease. That condition he defined as one in which the typical picture is of a child who walked with a cross-legged gait, who drooled, perhaps grimaced, and who was feeble-minded.

This became the typical conception of the spastic. It was found that the spastic was then differentiated from infantile paralysis, the other chief condition which comprised the large division of neuro-muscular handicaps.

Thus there were two divisions made, flaccid or infantile paralysis, and the spastic, which was supposed to be the opposite.

The treatment of the second type of case, the spastic, made very little headway for a long time, mainly because of the picture that had been painted by Dr. Little. They were generally considered feeble-minded, and this blocked all reason for treating them. The result was that the group, as a whole, was more or less neglected, except for a few individuals who were particularly interested in them.

However, very gradually, it became apparent that there was no such general classification as the spastic. The term, as generally used even at the present time, includes all non-flaccid conditions, and that, of course, is incorrect because less than fifty percent of this group is actually spastic.

In studying the group, it has gradually appeared through the writings of a good many different workers from different points of view that spastic paralysis is not a single condition, but a large number of conditions for which the term is a sort of waste basket.

Obviously, if the question of treatment arises, it is absolutely impossible to expect any one form of treatment to succeed in all these dissimilar conditions. If it were an entity, a single treatment could be devised which would be effective, but "the spastic" is not an entity.

Also, it has been found that by no means all of these are feeble-minded. Of course, a great many of them are retarded, since in the first place, because of their handicap, they do not have the advantages that other children have, and in the second place (which is more important) they have had the handicap since birth. This puts them in a different category from the infantile paralysis group, in whom the primary action patterns were formed before the paralysis set in and recovery does not involve teaching primary action patterns. If a child had infantile paralysis the day he was born, the condition might be more similar.

All tests for intelligence are dependent upon a motor response of some sort, even if it is simply a smile or a grimace; so that the response to any test given will be modified, depending upon the motor handicap present.

A good deal of advance has been made in the methods of testing the intelligence of this group of children. Miss Elizabeth Lord, in Boston, and the Research Department of the Vineland Training School have done much to solve this problem, which has made the evaluation of the intelligence much more accurate.

If an attempt to decide what this group of spastic paralysis, as opposed to flaccid, includes, it will be found that there are several ways of approaching the problem.

The neurologist will approach the problem from the point of view of where the lesion is, whether it is in the motor cortex, whether it is in the basal ganglia or the cerebellum, the internal capsule, or in the cord. All of these locations can be determined with a fairly high degree of accuracy, but to determine that a lesion lies in the lenticular nucleus does not help in the treatment of the case in the slightest. As a matter of fact, it does not make any difference to the physical therapist whether the lesion is in the cortex or the sub-cortex. Of course, this must be determined in the examination of the child in order to determine other factors, such as intelligence, since if the lesion should occur in the base of the brain and the cortex is entirely intact, there may be no good reason for believing there is any intelligence defect at all.

It is important to classify these cases with regard to their intelligence, because if the intelligence is obviously impaired, then there is no use in treating them.

However, the physical therapist should classify these cases by the motor handicap itself. She should find out what is the matter with the muscles.

In treating infantile paralysis, a great deal of attention is paid to the condition of the muscles, and yet the disease is a spinal cord disease. But it does not help the physical therapists or the orthopedists to know which anterior horn cells are involved.

In the other group which comprise the cerebral palsies it is also possible to find out exactly what is the matter with the muscles.

First it must be determined from the physical therapists' point of view what spasticity is and what athetosis is. These two conditions of the muscles comprise about

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eighty percent of the total number of cerebral palsies, and the two are totally different from each other.

For purposes of treatment, spasticity may be said to be a condition of the muscle in which it is hyperirritable to any stimulus applied to it. That is, it will contract more forcefully than normal no matter what stimulus is applied. A clap of the hands or a tap on the knee to produce the knee-jerk will bring about forceful contraction of the muscle. The most common stimulus applied to a spastic muscle is stretching. This stretch is produced by the contraction of the antagonist in flexing the joint and will tend to cause a contraction of the muscle in the same way that any other stimulus will. The resultant contraction blocks the motion to a greater or less degree depending upon the degree of spasticity in the muscles. For example, if the biceps is spastic and the patient attempts to extend the arm by the action of the triceps, the mere stretching of the biceps will cause a reflex contraction of it and this contraction will block the motion of extension of the elbow. The usual slow difficult extension of the arm, so often seen, will result.

Spasticity is a constant condition. Whenever a muscle is stimulated by a stretch reflex or any other stimulus, a hyperactive contraction will always take place. But in the examination of a particular arm or leg the spasticity or lack of spasticity in each of the individual muscles can be tested. This is most easily done by starting the motion passively from a flexed position and rapidly extending the joint. If this extension and consequent stretching of the muscle brings about a resistance which appears as soon as the motion is started, the particular muscle being stretched may be said to be spastic.

In the examination of a given arm or leg, all of the muscles will not be found to be spastic. Some of them will not show this resistance to passive stretching. These latter muscles will be found to be of two kinds: those which do not resist passive extension but are capable of contracting in the normal manner, allowing for possible spasticity in their antagonists; and those which are not capable of contracting at all, even if the spasticity of the antagonist is entirely overcome by the examiner. For example, two children may be brought to the physical therapist who have spastic legs, yet one of these children will be a toe-walker and the other will place the foot squarely on the floor. If the gastrocnemius soleus muscles are examined in both cases, let it be supposed that they are both found to be spastic. That is to say, they show resistance to passive stretching with maximal contraction. If, in this case, the foot is fully dorsiflexed and then brought sharply down into plantar flexion, it will be seen in one instance that there is no resistance to this motion and in the other instance that this motion is resisted by a spasm in the tibialis anticus. In the first instance, if the tibialis anticus is a normal muscle it will be possible for it to pull up the foot slowly against the spasm of the gastrocnemius. But in many instances the muscle is not active and does not pull the foot at all. This patient would be a typical toe-walking spastic while in the other patient the spasticity of the tibialis anticus would balance to a great extent the spasticity in the gastrocnemius soleus. The foot, while not capable of very much motion in either direction because of the stretch reflex applied to both muscles every time their antagonists are moved, is nevertheless capable of being placed flat on the floor. In the first case, the patient will attempt to dorsiflex the foot by means of the toe extensors, but no motion in the ankle will take place.

In this way a muscle examination similar to that used in infantile paralysis may be done on spastics a the various muscle findings charted as spastic, norm or flaccid, instead of the various degrees of streng used in the muscle examination in poliomyelitis.

Having made this examination, treatment may carried on according to the findings in the various mu cles. In the spastic muscle, of course, no stretching massage should ever be utilized, as this form of tre ment will bring about a reflex contraction of the mus and gradually increase the strength in it. If the mus tests normal, of course there is no necessity for tre ment of any sort, as the muscles are fundamental normal. The third group, those muscles which are flacc or zero, must have treatment similar to muscles in poli myelitis which are flaccidly paralyzed. That is to sa massage may be used and splints or other means preventing undue stretch of the muscle may be appli for at least a part of the twenty-four hours each day.

Some years ago a case was seen in which the tibia anticus was flaccidly paralyzed in an otherwise spas leg. On observing this patient walking around in barefeet, it was seen at times that the tendon of t tibialis anticus on the front of the ankle stood out pro inently. Yet it was impossible to bring about a contra tion of the muscle by any voluntary attempt. After period of observation it was noted that this muscle co tracted whenever the boy performed a resisted hip flexio He was therefore placed on the edge of the table in t sitting position with the legs hanging over the side the table and resistance was applied on the dorsal su face of the knee. The patient was asked to perform h flexion. This resulted each time in a forceful contracti of the otherwise apparently flaccidly paralyzed musc This resisted hip flexor exercise was carried out until t muscle was built up by the exercise. At the same tim massage of the muscle was given. The patient w directed to attempt voluntary dorsiflexion of the fo insofar as possible while performing the hip motion.

Gradually the resistance to hip flexion was reduc with the patient's attention focused on voluntary dors flexion, until finally all that was necessary was for t patient to think of hip flexion without performing it a dorsiflexion of the foot would result. This was carrie out later in the supine lying position with the kne straight and the resistance again gradually reduced wi voluntary mental flxation on dorsiflexion of the ankl Eventually, after a period of many months, it was fou that the simple motion of flexing the hip ten or fifte degrees forward in walking was sufficient to bring abo a coincident dorsiflexion of the foot and the patie became a heel-walker instead of a toe-walker.

Upon examination of other patients it was foun however, that this particular association of moveme was not a constant finding In some with equally pa alyzed tibialis anticus muscles, hip flexion produced n results whatever. In some instances the desired resu was brought about by resisted adduction, by knee flexio or extension, or by some motion of the arm. It is ap parently an overflow reaction but is specifically co trolled by some particular resisted action elsewhere i the body which is not a constant finding for a given mus cle. However, this particular association of hip flexio with dorsifiexion by means of the tibialis anticus wa found more commonly than any other associated action

Another patient, a girl, was seen who had had a tenotomy of her adductor muscles in another hospital. Previous to this tenotomy she had been able to stan by means of adducting the legs and slightly flexing th knees. She obtained balance by means of this pressure

of the knees against each other with some flexion in them. She was not able to contract the gluteus medius muscles on either leg.

Following the operative procedure, the girl was unable to stand by herself at all. She came to us in this condition. Examination showed an apparently flaccid paralysis in both gluteus medius muscles. It is probable that the tenotomy of the adductors would have caused her legs to fly out into adduction had the gluteus medius muscles been spastic, or to have contracted somewhat even had these muscles been normal. But because of the apparently flaccid paralysis no deformity or shortening of the gluteus medius muscles had taken place following the operative procedure. Upon examining her carefully it was found that the muscles could be caused to contract slightly by resisted abduction of the arms. Using this as a clue, the muscles were exercised each day with the legs on a polished board, bringing about contraction of the gluteus medius muscles by resisted abduction of the arms. They were also given extensive massage. After several months of this treatment the patient was able to stand and balance, provided an elastic webbing was wrapped around the body and arms and she could push against it by attempting to abduct the arms. It is hoped that she will be able to continue and eventually, as the gluteus medius muscles become stronger, attain balance without the bandage around the arms.

This and the previous instance of cases is given to show the methods of treating the flaccid muscles which are found among the spastic ones in most truly spastic patients.

It is a well known fact that it is unwise and useless to stretch spastic muscles. But it must be borne in mind that if the antagonists of spastic muscles are flaccid there is considerable possibility of real contractures taking place in the spastic muscles. It must also be remembered that spastic muscles only contract while the stretch reflex is being applied to them. They may be pushed to the fully stretched position and then held that way by means of a splint at night without there being a constant pressure against the splint. This is wise if the antagonists are flaccidly paralyzed or weak, in order to allow these antagonists to become stronger. In a toe-walking spastic, for example, every time the foot is placed on the ground a stretch reflex is applied to the spastic muscle which tends to make it become stronger and stronger because of the constant exercise given to it. To prevent this, a high heel is placed on the shoe during the walking exercises in order not to over-strengthen the spastic heel cord by the constant stretch reflex applied to it. This does not at first seem logical but if it is remembered that during the night splints may be used, bringing the foot up to a right angle to prevent the stretch of the dorsiflexors, then the amount of stretching that these muscles get will be reduced by half which appears to be all that is necessary in many of these cases. The heel can be lowered gradually as the dorsiflexors become stronger and the plantar-flexor becomes weaker from the comparative lack of use.

The muscle difficulty and description of cases which have been given represent true spasticity and not by any means the whole group of handicaps of intra-cranial origin. They represent perhaps forty percent of the total cases. Another group comprising approximately forty percent of the total are cases of athetosis. These cases are very frequently mistaken for spastic in the true sense of the word. They are especially characterized by involuntary motion. Superficial examination of these cases will in many instances give evidence of hyperactive knee-kicks, for example. The knee-kicks will be seen to give a hyperactive response at some times and will not give a hyperactive response at other times.

By the definition given of spasticity it will be seen that as the muscle is hyperactive to all stimuli, the reflexes must be constantly hyperactive. How, then, can intermittent hyperactivity of the reflexes be explained?

The usual method of reinforcement of the knee-jerks in cases where they are sluggish is to ask the patient to clasp the hands and make a sudden pull at the same instant that the knee is tapped. In this way the knee-jerk is reinforced and a more active response is obtained. In cases where involuntary motion is taking place, it is the usual habit of the patient to attempt to control this involuntary motion by tightening various muscles in different parts of the body. This tightening will result in a reinforcement of a normally active knee-jerk and very strongly simulate a hyperactive reaction. Great care therefore must be observed in testing the different reflexes of all cases suspected of spasticity or athetosis.

Athetosis may be described as a series of involuntary motions which affect one muscle after another throughout the extremities without any particular order of contraction. The contractions may be rapid or may be slow and are entirely beyond the control of the individual. They usually start, for example, in the shoulder and extend gradually throughout the muscles of the arm down to the fingers. By the time the train of contraction has reached the fingers another train has started in the shoulder, so that the arm is carried through a series of involuntary motions with several joints moving at the same time. The degree of athetosis is measured in frequency of contraction, speed of contraction and amplitude. The amplitude, or in other words the force of the contraction and the resultant amount of motion through which the arms is carried by the contraction, varies very much with the degree of tension under which the patient is at the time. In sleep these motions disappear entirely and when the patient is extremely sleepy they are of very small amplitude. They also decrease in frequency with relaxation.

It is the tendency of the athetoid to control these motions by tightening to prevent the part from moving. This tightening does not produce the desired effect. It rather brings about a stiffening of the extremities and an exaggeration of the total involuntary movement. A simile may be made to a normal individual attempting to walk down the aisle of a moving railroad car. Although this individual has perfect ability to move the muscles of the legs at will, there is applied to him an external force which steers the motion in other directions than he intends them. It is also true of attempting to write a letter while riding in a rapidly moving automobile. The tendency is made to tighten up all the muscles to prevent the writing from becoming illegible. But the more the muscles are tensed, the worse the writing becomes because every shock of the automobile is transmitted to the ends of the fingers. If relaxation instead of tension is attempted, the motions will be seen to diminish very greatly as each joint then acts as a shock absorber. The athetoid patient attempts to control his motions in the same way by tightening the muscles, which actually makes the condition worse than before. The fact that athetosis disappears in sleep is important in treatment, because the more relaxed the athetoid patient becomes, the less power and consequently amplitude of motion takes place as a result of the involuntary motion. If an athetoid patient is asked to shake hands,

he will thrust the hand out quickly to the examiner and attempt to make contact to shake hands before athetoid motions enter the picture and steer the arm in the wrong direction. In contrast to this, shaking hands with a spastic will produce in the patient a very slow forward motion of the arm as the muscles interfere with the motion by the stretch reflex. This little test is a very simple way of determining fundamentally whether the patient is suffering from spasticity or involuntary motion.

Relaxation then is the important part of treatment of the athetoid patient. Relaxation has been described by Jacobson in his excellent book, "Progressive Relaxation," and he presents there a definite method of carrying out this technique. It is written especially for normal individuals to help them to reduce the tension of their lives, and is not especially written for the purpose of treating handicapped individuals. In these, it is often necessary to modify the technique used to some extent because the patients are not of the type for which the original treatment was described. For example, the relaxation according to Jacobson's method, begins with the fingers and then goes to the wrist, elbow, and shoulder in that order. In cases of athetosis it is not of any value to have a perfectly relaxed hand if the shoulder is moving the arm around away from the body. It is therefore necessary to begin with the treatment of the proximal joints such as the shoulder and work gradually downward ending with the hand. This work has to be carried out gradually, and in many cases muscle by muscle, in order to accomplish good results. It is sometimes necessary to concentrate on one joint such as the shoulder, paying no attention to any other joints until this has been brought under complete control. Results vary a good deal. In patients who have normal mentality and who are cooperative, athetosis has been almost entirely eliminated in some, while in others, very little advance can be made. When it has been eliminated, under good circumstances the problem arises to teach the patient how to apply relaxation under all sorts of exciting and disturbing situations in order to maintain the absence of athetoid motions through any type of situation in which he may find himself.

Muscle training, or muscle re-education, is not of primary importance in the athetoid patient because of the fact that the fundamental ability to move, underlying the involuntary motion, is entirely undisturbed. Thus the athetoid may flex or extend a joint at will with equal ability to that of any normal individual but this motion is often interrupted and disturbed by the overlying involuntary motion. Therefore, when the involuntary motion has been removed, voluntary motions are no longer disturbed by them and normal action is usually the result. It is difficult, however, to teach the patient to move a joint from the relaxed position without allowing a recurrence of tension to creep in and upset the picture. In young children, therefore, it is sometimes necessary to institute muscle training in athetosis in order to condition them to move to the accompaniment of certain rhymes as in spastics, after the manner which has been developed by Miss Trainor in Boston. Often it will be seen that a child who is unable to move a joint without stirring up tension and starting off a large amount of athetoid motion will move his arm without these involuntary motions after conditioning to a rhyme, so that the arm moves more or less without the patient's attention. The stimulus of the rhyme may then be broadened so that motions will take place in a much more free manner. Therefore, the treatment of the athetoid may vary considerably, depending upon the age of the patient and the particular environmental situation.

The emphasis therefore must be placed on relaxation in the athetoid, while in the spastic it is placed on attention to the non-spastic muscles both normal and flaccid as well as to the spastic ones. There are, of course, mixed cases of spasticity and athetosis which occur. A diagnosis of both conditions must be made with great care, however, as the stretch reflex of one joint will react upon another and produce a train of contractions in the spastic which may simulate athetosis very closely. The usual difference, however, is that in the progressive stretch reflex the disturbance usually moves proximally while in athetosis it usually is a distal train of motion.

Spasticity and athetosis comprise the two main groups of motor handicaps of intra-cranial origin and constitute about eighty percent of the total number. In the remaining twenty percent there is a group of cases all of which are comparatively rare. The most frequent type in this group is that in which incoordination is characteristic of the disabilities. Athetosis, of course, represents incoordination but this incoordination is of a secondary type and based upon involuntary motion taking place. In primary incoordination, it is impossible for the patient to steer the joint in the direction in which he wishes from the very start of the motion. These cases are to a large extent cerebellar in origin. In these, there is no evidence of tension or spasticity and upon observation with the patient at rest it will be seen that there is no involuntary motion. Therefore, there is no advantage whatever in relaxation therapy in these cases.

The treatment is entirely aimed at coordination therapy by muscle training. A study must be made to determine whether the incoordination is due to muscle imbalance or to a disturbance of the coordinating mechanism in the cerebellum or some other part of the brain. An attempt is then made to increase the coordination much in the same way as normal individuals may be coordinated in the practice of a difficult technique.

Tremors represent another group in this last twenty percent. Tremors are not always obvious at first as there may be tremors of two or three different joints which have a different speed. Therefore, the resultant picture resembles more closely athetosis than tremor at first sight. Some tremors are intention and some are non-intention. The treatment of these depends upon, first, a careful evaluation of what muscles are involved in the tremor, and then relaxation therapy to decrease the amplitude of the tremor combined with teaching motion from the relaxed position.

Certain cases are seen in this group which are not pathological at all but simply represent exaggerated normal overflow. Overflow may be described as motion of unessential muscles taking place concurrently with a willed motion somewhere in the body. Examples of normal overflow are seen in individuals who twist the mouth in trying to write and others who turn the feet or twist the toes when attempting to untie a difficult knot. This type of difficulty is usually habitual and as easily eliminated as is any other ordinary habit.

Overflow is an important complicating condition in spasticity and athetosis and other forms of cerebral handicaps. It must be remembered that in these individuals almost any act corresponds to a very complicated and difficult act in a normal person, and normal overflow is likely to be exaggerated since overflow in the normal individual increases with the complexity or difficulty of an act. The amount of extraneous muscle contraction

occurring in spasticity, athetosis, tremor or incoordination which is due to overflow must be separated out and eliminated by the usual methods of eliminating a bad habit of action. It can usually be determined after several observations, by its consistency; that is, it usually accompanies a given motion and is reproduced each time the motion is attempted.

The treatment of these patients represents the teaching of a skill, and skills are taught by specialists in various forms of sport and in the various fields of art and music as well as other types of skilled activities. Results in the mentally normal patients should not be expected more quickly than one would expect a normal individual to become proficient in piano playing. The number of treatments given and the amount of time devoted to practice of the exercises should be gauged to some extent with the thought in mind that these patients are being taught a skill. The experience of music teachers and athletic trainers is a great help in determining how much to expect and how long a continued activity should be followed.

Staleness is likely to develop if the patients are over treated and it is customary to give them a month's vacation each year in order to avoid it. It seems in most cases unwise that the patients should work more than an hour at a time each day on the exercises, as staleness will develop from too long persistence each day. Aside from the hour or time spent on the exercises, the patient should forget them for the remainder of the day and be perfectly free to follow his usual routine of life without being reminded constantly of the necessity to correct his motions. It is hoped that the bare outline of the treatment of these handicaps which has been given will be of aid in the attempt to rehabilitate this group of handicaps.

Early Motion in Elbow Fractures

Rudolph S. Reich, M. D., F. A. C. S.

The end result following the treatment of a fracture, especially if it is in, or adjacent to, a joint, is dependent upon anatomical and functional restoration following reduction. Obviously, we strive to obtain the best functional result, and this is dependent, to a great extent, but not entirely, upon a proper anatomical reduction.

After a fracture has been manipulated into a satisfactory anatomical reduction, it is also important to maintain this reduction until healing has taken place. Those of us who have paid more attention to the treatment of fractures, and particularly to the economic phases, must be very much interested in restoration of function as rapidly and as near normal as possible.

This idea of early restoration of motion seems to have pervaded the modern medical literature, and as a result, a great deal has been written about the early active and passive motion of joints adjacent to fractures. In fact, there have been those who have advocated removing dressings and splints very shortly after reduction of fractures in or near joints to promote active and passive motion, with the idea that it will improve ultimate function and considerably shorten the period of disability. Böhler has shown very conclusively that active and passive motion does considerably shorten the period of disability, and he has advocated various types of walking splints; in fact, one of the most important features of the treatment is early locomotion, regardless of whether it is a fracture of the spine or hip.

It is my opinion, however, that we have been overenthusiastic about this matter of early movement *when splints and dressings have to be removed to accomplish it*. Unquestionably, anatomical results and, consequently, functional results have been impaired rather than enhanced because of this over-enthusiasm for early motion. When we study the physiological phenomena that take place early in the healing of fractures, the rationale of this practice of early motion may be better understood. Shortly after the occurrence of a fracture, there is an extravasation of blood into the fracture area which develops into hematoma. This hematoma is the medium in which osteogenesis is laid down. There is the early phenomenon of absorption or rarefaction along the adjacent fracture surfaces which occurs because of the extrusion of osteoblasts which are poured into the hematoma.

When one studies a roentgenogram taken two or three days after the occurrence of a fracture, one can easily demonstrate areas of absorption along the fracture lines, and frequently it appears as though the fracture lines are more widely separated. This is merely the manifestation of the first stage of osteogenesis.

In many instances, especially in oblique fractures, when the maintenance of reduction of a fracture is dependent on the impingement of a small ledge of bone, we are often chagrined to find that the fragments are again out of position. This loss of reduction is unquestionably due to the process of rarefaction that has taken place early in the course of healing, aided and abetted in many cases by muscle pull. This is also frequently illustrated in impacted fractures of the wrist joint, where, feeling that impaction of the radius has been satisfactorily and completely overcome so that the level of the

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Cuts reproduced by courtesy of "The Journal of Bone and Joint Surgery."

articulation of the radius is at the level of the ulnar articulation, one finds that there is shortening of this radius two or three weeks after reduction. The invariable end result is radial abduction of the wrist with undue prominence of the styloid process of the radius, and when the patient calls the doctor's attention to this, it is often very disconcerting.

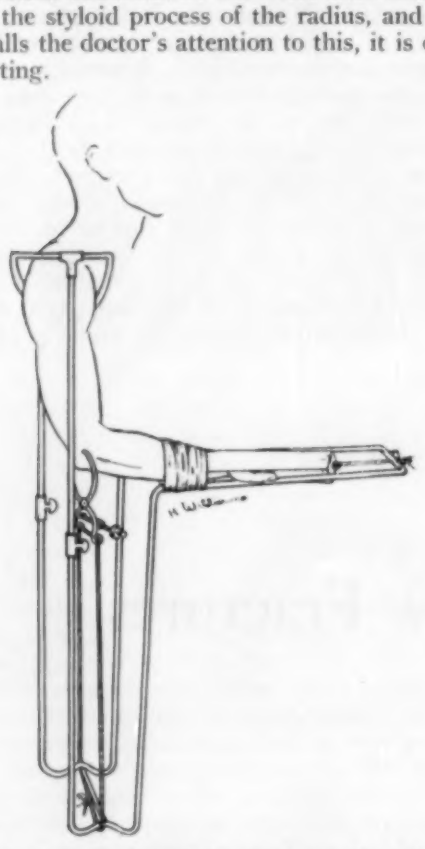

Fig. 1. Reduction of intercondylar fracture with skeletal traction in modified Jones humerus splint

Since supracondylar fractures are common injuries in the elbow, particularly in children, let us consider for a moment the type of disability that is usually present. This fracture is caused by a fall with the arm extended and the impaction against the open hand. If the fracture is a supracondylar one, the distal condylar portion is also displaced posteriorly and often dislocated and completely separated from the proximal fragment. This deformity requires a stereotype form of reduction; namely, impingement of the distal fragment on the proximal one and as much flexion of the elbow as swelling will permit in the Jones position, in order that the anterior curve of the lower portion of the humerus may be restored and maintained.

It is not unusual to find such an increase in the swelling around the elbow that the function of the elbow, and sometimes of the forearm and hand, is jeopardized because of the danger of ischemia and consequently Volkmann's ischemic contracture. It is not unusual to find that the reduction has been lost entirely or in part because of the change of position, and subsequent reduction has to be resorted to. It behooves one, therefore, not to jeopardize the position of a fracture of the elbow by early active and passive movement when one has obtained a satisfactory reduction which has to be maintained by splints or dressings. It is my firm belief that this immobilization should not be disturbed until the roentgenogram demonstra sufficient callus formation that movement will not affe the alignment. From that point on, active and passi movements should be encouraged, together with the oth therapeutic measures which assist in functional resto tion. Such a course of treatment may prolong the to period of disability, but one is more certain of achievi satisfactory end results, and particularly a functio result.

Theoretically, early motion of the elbow joint is all odds the most satisfactory course to be desired; esp cially in the very complicated fractures in and about t elbow joint. As a general rule, this is the usual type fracture which occurs in adults, and the supracondyl fracture is extremely rare in adults. But how is one continue active and passive movements without jeo ardizing the anatomical position? These movements c be carried out when the anatomical splinting and co sequent fixation of the fragments is of such a nature th the fragments are so thoroughly immobilized that mov ments of the elbow joint will not influence the positi of the fracture ends. With the advent of skeletal tra tion, one is able to thoroughly fix fragments of bone a apply such apparatus as will maintain this fixation that movement can be safely encouraged. Skeletal tra tion has been used occasionally for fractures in a around the elbow joint. We have had occasion to some rather complicated fractures of this type in whi we have been able to institute early active and passi movements, thereby achieving much more satisfactory r covery than probably would have been accomplish otherwise. This, however, can be carried out only fixing the epicondyles of the elbow joint by means of caliper skeletal traction to a Jones humerus splint or a Thomas arm splint with a hinged attachment exten ing at right angles from the site of the elbow joint by the use of a modified counter traction in the axil In this way, the humeral fragments are thoroughly i mobilized and joint motion is carried on entirely ind pendent of the fracture lines through the forearm. The are those who advocate extension by the insertion of Kirchner wire through the olecranon process of the uln When the elbow joint is moved, there must necessari be some motion in the condylar portion of the elbow joi because the fulcrum of the elbow joint has been tran ferred from the humero-ulnar articulation to the tip the olecranon process of the ulna. Moreover, active a passive movements are carried out with greater difficul

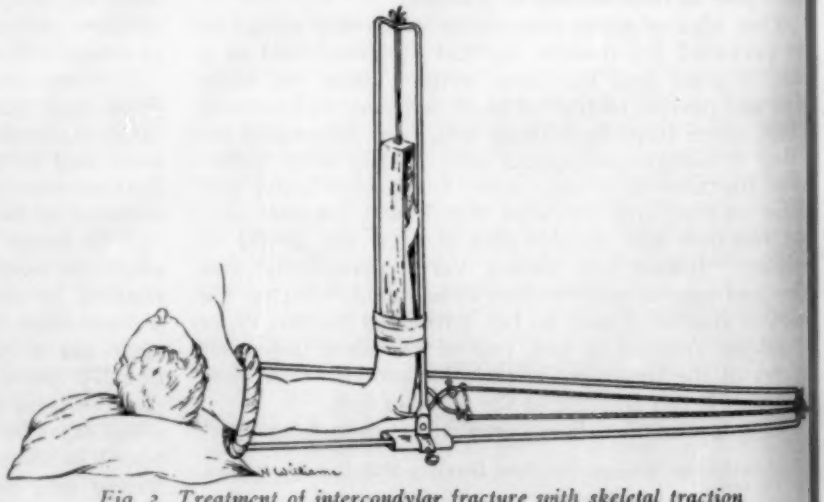

Fig. 2. Treatment of intercondylar fracture with skeletal traction in Thomas arm splint

because the elbow joint is partly fixed by this method of traction.

In fractures situated in a position slightly higher than the supracondylar fractures, adhesive plaster traction frequently proves adequate to provide and maintain satisfactory reduction. It has been my experience that when this traction is extended from the point of fracture across the extended elbow joint and it includes the entire forearm, disastrous results occur from the prolonged immobilization of the elbow joint in the extended position. A long period of time is required to restore joint motion, partly because of the immobilization of the joint but mainly because of the stretching of the joint capsule by the traction with resultant periosteal reaction. When adhesive traction has been applied, it is rarely necessary to extend it beyond the elbow joint; therefore, the forearm may be entirely free and in the right-angled position, thus permitting freedom of active and passive motion with impunity. When the fracture is nearer the elbow joint, it is my experience that any type of adhesive traction is unsatisfactory and some form of skeletal traction, as reported above, is necessary.

One must not gain the impression that skeletal traction from the condylar region is advocated as the method of choice for complicated fractures of the elbow, but this method of fixation has proved to be much more efficacious in the complicated fractures where the epicondyles have been fractured and disorganized.

Assuming that we have obtained a satisfactory fixation of the fragments by means of traction and splinting, when should active and passive movements be initiated? Since the elbow joint is occasionally the seat of exhuberant callus formation resulting in myositis ossificans with complete ankylosis of the elbow joint, it would be much more judicious to defer movement for a few days until the usual inflammatory reaction accompanying the fracture has subsided and the area of callus formation has become self-limited. This occurs very rapidly in children, usually from two to four days, whereas in adults, this early callus formation requires a few days longer. Therefore, in my opinion, active and passive movement should be deferred for from five to seven days. In the meantime, muscle setting exercises of the arm and forearm may be instituted to maintain muscle tone, and massage and active movements of the wrist and finger joints may be initiated almost immediately.

Summary

Summarizing the subject of active and passive movements around the elbow joint, we must remember: (1) that absorption takes place along the fracture surfaces in the process of extrusion of osteoblasts into the hematoma, which causes a slight amount of separation of the adjacent fracture surfaces. Either by the slightest amount of movement or by muscle pull, this surface of absorption is subject to displacement. Therefore, active and passive movements should not be instituted around the elbow joint, provided the fixation is dependent upon splints and dressings, until the fragments are well fixed by callus. (2) In complicated supracondylar and intercondylar fractures, the fragments are held in position by skeletal traction to a Jones humerus or a Thomas arm splint, and active movements may be freely employed because the fragments are fixed independently of movement of the elbow joint. (3) Because of the reaction that is usually found early in the process of the healing of fractures and the consequent danger of exhuberant callus formation, it has been good judgment to defer active and passive movements two or three days for children and five to seven days for adults, therapeutic measures to be confined to maintaining muscle tone and function of the wrist and finger joints.

The Treatment of Acute Osteomyelitis

Edward LeCocq, M. D.

Osteomyelitis must be considered as a general infection with local manifestations in the form of bone abscesses. If the blood stream infection can be successfully combated, then recovery may be brought about. The treatment of the bone abscesses is a local problem only.

Some years ago the writer was induced to employ neosalvarsan in the treatment of a case having a blood stream infection with associated osteomyelitis of the femur and a suppurative pericarditis. The offending organism was the staphylococcus aureus. As a result of treatment with this drug, a complete recovery occurred. Since that time, neosalvarsan has been used successfully in numerous cases of acute osteomyelitis. The results have been most gratifying.

In summarizing the results of this treatment, only those cases were used which showed a virulent infection of short duration. Cases of weeks' standing and those with low grade temperature were not included in this series.

In twenty cases of acute osteomyelitis, the blood culture being positive for the staphylococcus aureus, nine deaths and eleven recoveries occurred. The results may be tabulated as below:

Received no neosalvarsan and recovered	1
Received no neosalvarsan and died	6
Received neosalvarsan and recovered	10
Received neosalvarsan and died	3

From the above, we can see that the mortality rate has been reduced from about 85 percent to approximately 23 percent through the use of neosalvarsan.

At the present time, the matter is receiving further attention; some experimental work is being conducted, both in the field of laboratory examination and animal experimentation. Further reports will be made at a future time.

Seattle, Washington.

Acute Osteomyelitis of the Jaw and Its Complications

Frank H. Wanamaker, D. D. S., M. D.

The acute suppurative conditions which occur in the teeth and in the maxillary and mandibular bones quite frequently spread to other important structures of the head and neck, producing violent local and systemic manifestations which are often refractory to treatment. According to Leibold,[1] osteomyelitis of the mandible occurs eighth in frequency, the order of its occurrence being femur, tibia, humerus, radius, ulna, vertebra, os calcis and mandible. The mandible is more often infected than the maxillary by about seven to one. Males and females are affected in about the ratio of three to one, respectively, and no age is exempt. The severity of the condition is usually in inverse proportion to the age, being much more fulminating in infants than in adults. This is due to bone development, there being a greater spongiosa at this age, and also to the development of the tooth germs. The primary etiology of the necrosis is either odontoginous or hematogenous resulting in a thrombosis of the blood vessels, and the extent of the necrosis depends on the size of the blood vessels involved. Going back to our anatomy, the superior maxillary receives its main blood supply from the following branches of the internal maxillary artery, the posterior alveolar, the posterior dental, the anterior dental and the infra-orbital. They loop themselves around the bone at various levels and intervals. The mandible depends for its nourishment on one large vessel, the inferior dental artery which gives off a few branches to the condyloid and glenoid processes before entering the inferior dental canal, where it continues through the bone to the region of the first bicuspid tooth, dividing there into a mental and an incisor branch. The incisor branch continues forward to anastomose with that of the opposite side. There is very little collateral circulation in this area.

These bones support from fourteen to sixteen teeth each and are often subjected to severe trauma as (a) blows and fractures, (b) caries, (c) operative manipulations, (d) malocclusion and (e) thermal shocks. Lain[2] of Arkansas recently pointed out that in saliva with an acid or alkaline base, either above or below a PH. 7, there is a veritable electric battery set up in the mouth strong enough to cause hyperaemia followed later by devitalization of the dental pulp and subsequently an apical abscess. Suppurative processes at the apex of a tooth usually perforate through the soft tissue and drain into the mouth, forming the so-called gum-boil. It may point either bucally or lingually under the periosteum and form a subperiosteal abscess. It may spread along the floor of the mouth or dissect along the bone into the tonsillar area and simulate a pharyngeal abscess. It may point externally and produce a discharging fistula which ultimately heals, leaving a crow-foot scar. Frequently the suppurative process spreads upward anteriorly to the maxillary bone and ruptures beneath the orbit o the face or into the floor of the nose. It is common to fin teeth penetrating the maxillary sinus and setting up suppurative process there. The more chronic type abscess (blind abscess) may form a fistula along th root of the tooth and drain into the mouth or it ma be absorbed directly into the blood stream.

Hendrice and Hartzell[3] in an examination of forty six dental pulps found streptococcus viridans in twenty eight, staphylococcus albus in eight, and other bacteri in the remaining ten. Their conclusions were: in approximately one-half of the vital teeth invaded by caries surrounded by chronic suppurative pericementitis, th pulp is already infected by streptococcus. Lucas[4] mad cultures from remnants of enamel organs of completel unerupted teeth and all were found to be infected eithe with streptococcus viridans or staphylococcus albus.

These findings might explain the presence of pul abscesses that are found in apparently sound teeth. Suc dormant abscesses may not present any acute symptom until they are opened, then undergo violent exacerba tions of the inflammatory process, terminating in th loss of the tooth and surrounding bony structures. I extreme cases, metastatic foci, such as infection of othe bones, kidney infarcts, suppurative arthritis or acute en docarditis may be established. Recently von Phul reported three cases of subacute bacterial endocarditis all in young adults, resulting from the removal of appar ently dormant abscessed teeth. The infection may b blood borne from some distant focus or foci as furuncles breaks in the mucous membrane and abrasions of th skin, but when suspicious teeth are present it may b difficult to draw absolute conclusions. Bacteria, whe they become arrested in a blood vessel, are capable o rapidly propagating and establishing suppurative proc esses.

Osteomyelitis of the superior maxilla in nursing infants is frequently very misleading in that it often simulates a suppurative dacryocystitis. Practically al writers agree that the disease must be of bacterial origin and a primary infection of the bone, the source of infection being the gums, the tooth germ, the nose or the antrum. Others believe that it is of hemotogenous origin. Wilinsky[6] believes that injury of the jaw occurs during parturition and that in the presence of unerupted teeth and teeth buds with their generous vascular supply, a thrombophlebitis develops by means of which bacteria are transmitted into the substance of the bone and not by simple extension from contiguity.

The history of a case is usually that of a healthy child suddenly developing severe general symptoms of an infection with swelling of the upper gums and hard palate which later extends to the cheek and orbit. As

Seattle, Washington.

abscess forms in the swelling, associated with exfoliation of the teeth buds, a purulent discharge from the nose, high temperature, prostration and perhaps convulsions. The outcome is healing with or without fistulization, the development of metastatic purulent foci, or the death of the patient.

Marx[7] in 1920 called attention to the ocular lesions sometimes associated with maxillary osteomyelitis in infants. Nord[8] again emphasized this fact in 1924. He gave as treatment: conservatism in drainage, seeking for abscess formation and immediately draining it; cleanliness of the mouth and nose; avoidance of external incisions in the care of orbital or antral complications; careful nursing and waiting for spontaneous separation of the sequestrum.

Dr. Virgil Loeb[9] of St. Louis, Missouri, brought out by a series of X-ray pictures that if the above treatment were carried out, especially the hygiene of the mouth, the tooth buds continued to develop and the slightly deformed teeth became fixed in the newly formed bone. This was verified later by Dr. V. B. Blair,[10] who reported seven cases.

The mortality is high, varying from twenty to fifty percent in the various series of cases reported in the literature. In a few reported cases in which sinuses or fistulae have opened into the floor of the nose, especially anteriorly due to maxillary bone necrosis with continuous purulent discharge, the erroneous diagnosis of chronic nasal catarrh might easily be made.

If the osteomyelitis is more extensive, accompanied by thrombosis of the posterior alveolar and the posterior dental arteries, there is necrosis of the alveolus which includes the lower and outer angle of the bony wall of the antrum. The antrum becomes infected by contiguity. Usually the findings of such a lesion are a foul gangrenous involvement of the upper jaw, sequestration of a large portion of the alveolar process, and eventually a large opening between the antrum and the oral cavity which after healing necessitates closure either by a plastic operation or soft rubber vellum.

Cases are frequently seen of maxillary sinusitis due to tooth infection or as a complication from periapical abscess of any of the teeth from the lateral incisor back to the third molar. Marshall[11] and others agree that the anatomic basis of this lesion is a thromboembolic lesion of the apical arteries. Ankylosis of the temperomaxillary articulation results from involvement of the glenoid process or from calcification of the muscular and tendinous tissues about the joint and upper part of the ascending ramus.

Wilensky reported a case of facial vein phlebitis following osteomyelitis of the mandible which spread upward into the cavernous sinus.

Occasionally general infection occurs as a sudden, acute, overwhelming exacerbation from a previously existing focus, usually a dormant periapical abscess and without any trauma from operative intervention. More often some operative procedure on the tooth or bone is the offender. General infections of this type are apt to be very extensive and malignant in that intracranial complications and other involvements may prove rapidly fatal. The above can be more easily explained by the following case:

A rancher, white, 72 years old, was admitted to the Swedish Hospital on May 23, 1934, giving the following history: Two weeks previous some of the right lower teeth had been extracted, after which considerable pain developed in the jaw associated with oozing of pus from the deep tissues. The right side of the neck became swollen; he complained of weakness and a temperature. Examination revealed a large ulceration along the right alveolar process with foul greyish pus. Patient was emaciated. His temperature ran from 101° to 103.4° daily; pulse from 140 to 160, irregular. He became rapidly weaker and expired two days later. X-ray of the lower jaw showed an acute osteomyelitis.

BLOOD COUNT

Erythrocytes	3,800,000	Eosinophiles	2
Leucocytes	82,400	Myelocytes	76%
S. Lymphocytes..	10	Hemoglobin	68%
Neutrophiles	12		

It is interesting to note the blood picture as it simulates a myelogenous leukemia. Had the patient lived longer, paralysis of the bone marrow would have developed, giving a picture of agranulocytic angina.

For the past five years, Dr. Edward LeCocq,[12] in treating cases of osteomyelitis of the long bones in children at the Seattle Orthopedic Hospital, has given .15 grams of neoarsphenamine intravenously to those showing general bacteriemia before he has obtained a positive blood culture. In cases that are positive of staphylococcus he has increased the dosage to .1 gram at two-day intervals. The mortality rate has been cut from 50 percent to 10 percent. At the King County Hospital in Seattle, two cases of positive staphylococcus albus blood stream infection gave good results by this method of treatment. Neoarsphenamine has been given also to individuals having several small necrosed areas in the bone, and the results were most gratifying in that sequestration was much less and the healing time much shorter.

Inflammations of the submaxillary fascias, including those cases of so-called Ludwig's angina in which the floor of the mouth is involved and trismus is extreme, usually yield promptly to drainage and can be given a fair prognosis. Occasionally these inflammations do not remain confined to the submaxillary space but extend into the parotid space or into the pharyngo-maxillary space or both, or it may spread downward into the lower part of the neck along the vascular sheath. These cases should be drained early and externally by the Mosher[13] technique rather than intra-orally, although some cases that localize internally and anterior to the attachment of the pterygoid muscles point far back and high up in the mouth. Due to trismus, the abscess is very difficult to incise. It usually ruptures spontaneously into the mouth, and if the opening can be found, bare bone can be felt at the bottom of the sinus. Thereafter the ankylosis, when due to the inflammatory exudation, subsides slowly until full motility is restored. If the sepsis continues and chills occur, the carotid sheath should be exposed surgically. If the blood cultures are positive, ligation or resection must be done immediately, as thrombophlebitis in distant veins may appear early.

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Technic of Acetyl-Beta-Methylcholine Chloride Iontophoresis (Common Ion Transfer)

Lulu Boerner, R. N.

Acetyl-beta-methylcholine chloride is commonly known as mecholyl. It has the pharmacologic properties of increasing the pulse rate, lowering the blood pressure, constricting the bronchioles, stimulating the activity of the sweat glands and the secretory glands of the gastro-intestinal tract, increasing intestinal tone, stimulating peristalsis and dilating the peripheral vascular system. The latter action has led to its use in chronic arthritis, peripheral vascular disease and chronic varicose ulcers.

This drug may be administered orally, subcutaneously or by "common ion transfer."[1] The latter method should be used when the local action is desired. At the site of its application by common ion transfer there is an increase of skin temperature 2 degrees to 4 degrees F. appearing in 3 to 4 hours and persisting for some time. There usually is local sweating which persists from 8 to 10 hours. There is an increase in the rate of capillary blood flow without enlargement of the capillaries or an increase in the number of visible capillaries.[2] The slight redness of the skin remains for about 2 hours, due, according to Kovacs,[3] to enlargement of the deeper small arteriole vessels.

In using mecholyl locally, the following general reactions must be watched: There is generally a slight fall in blood pressure. Occasionally this may continue to fall so that it will be necessary to stop the treatment. The immediate cessation of the effects of mecholyl is secured by the administration of one one-hundredth grain of atropine hypodermically. This drug should always be available for immediate use. Due to the constricting effect on the bronchioles, asthmatic attacks may be produced in those susceptible. This effect is likewise stopped by atropine. The other general reactions of flushing, salivation, lacrymation, and diaphoresis, may be alarming to the patient who should be reassured that these reactions are not serious. Occasionally intestinal cramps occur.

There are three possible sources of the galvanic current: first, the radio B. battery; second, the motor generator set; and third, the more modern rectifying tube machine. While the battery current gives a current quite free of any accessory fluctuations, this advantage is more than offset by the fact that the potential is continually changing. The motor generator sets have accessory fluctuations due to the passing of the brushes over the commutator, and hence there is a great deal of variation in the sensory effects of such a current. We have used the rectifying tube machine in treating our series of cases and have found it to be a most satisfactory machine for this kind of treatment.

At our clinic we have given 485 treatments to 35 patients with chronic arthritis. We have tried all the technics recommended in the literature on this subject, and have developed a technic which we believe is preferable to others which have been described because:

1. It can be applied satisfactorily to a hand or foot even if deformities or contractures are present, as often occurs in arthritis.

2. Perfect skin contact may be obtained, and wi careful application there is little danger of burns.

3. It is comfortable to the patient.

4. It is economical; no expensive electrodes a required.

5. It is simple and little time is required to mak the application.

We shall describe in detail our technic for mechol common ion transfer to a hand as that is perhaps t most difficult area to treat.

The dispersive pad, a 10-inch x 12-inch metal pla covered with electrode felt or cellucotton and saturat in a hot 1 percent solution of sodium bicarbonate sodium chloride, is applied to the back or abdomen that all areas are in close contact with the skin. applied to the abdomen when the patient is lying on h back it should be covered with a piece of rubber sheetin and held in place with sand bags. When applied to th back, a piece of rubber sheeting is placed under it prevent the moisture from being absorbed by the beddin and a square rubber air cushion or small pillow approx imately the size of the dispersive electrode under th to insure close contact. (See Fig. 1.)* The hot we dispersive pad, aside from being more comfortable t the patient, increases the blood supply, thus lowering th skin resistance and reducing the tingling sensation fel when the current is turned on. The metal plate shoul be attached to the connecting cord of the machine by metal clip before applying it to the patient. *To preven burns, care should be taken that no metal touches th patient.*

The 1 percent mecholyl solution is prepared b using one grain of mecholyl to 100 cc. of distilled wate The water may be tepid but never hot, as the highe

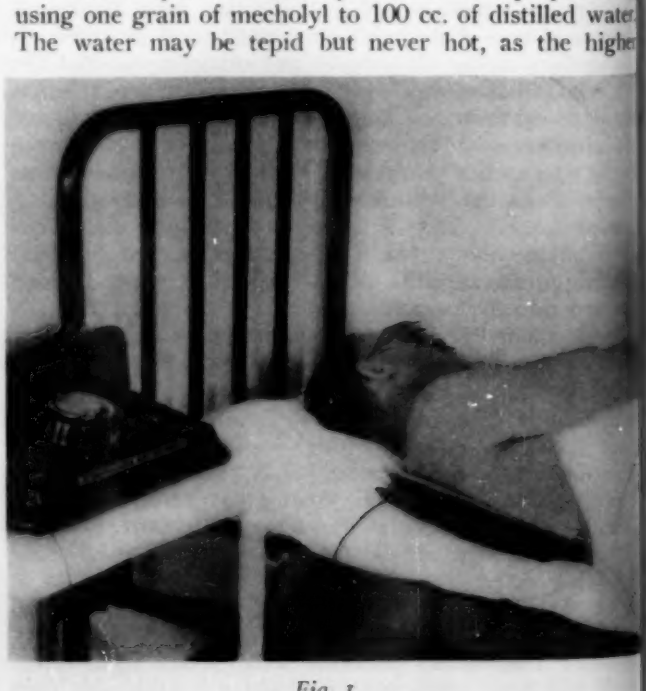

Fig. 1

Instructor, Department of Physical Therapy, Northwestern University Medical School.

Fig. 2

temperature changes the chemical properties of the drug. Large quantities of solution should not be made up unless it is to be used within a period of several weeks as it deteriorates.

The active electrode must be material that is absorbent but takes a minimum amount of solution. After considerable experimentation asbestos fiber paper was selected. The same paper may be used for several treatments during the same day by adding a little more solution. If it is to be kept several days it should be placed in a lightly closed jar and kept in a cool place.

The paper which is to be used for the hand must be wide enough to include the finger tips and to extend about two inches above the wrist joint and long enough so that it can be fitted in between each finger. (See Fig. 2.) For the knee it should be wide enough to completely cover the region of the capsule of the knee joint. (See Fig. 3.)

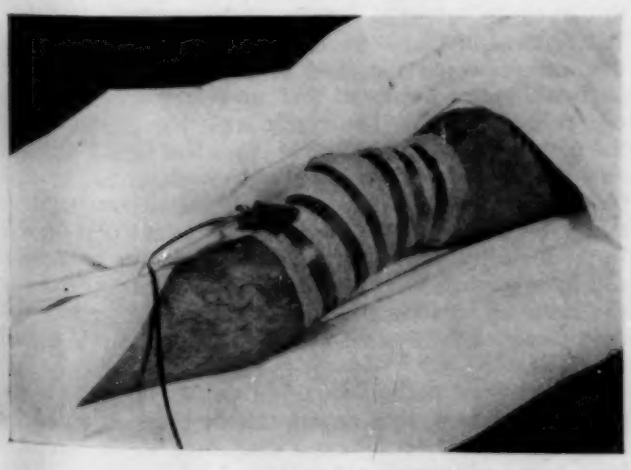

Fig. 3
Paper and foil as applied to the knee.

To moisten the paper it should be placed in a flat pan and small amounts of solution should be poured over it until the entire piece is thoroughly wet but not dripping; between 25 cc. and 40 cc. is usually sufficient for one treatment. The wet paper should be handled carefully to prevent tearing.

The hand, with fingers widespread, is placed on the center of the saturated paper. The paper is next folded over the top of the hand and fitted carefully between the fingers. The fingers are then drawn together and the paper smoothed over so that it fits snugly around the entire hand and wrist. A strip of ½-inch electrode foil is then wrapped around in a spiral with each turn about ½ inch apart over the entire area covered by the paper. (See Fig. 3.) We found a foil .008 inch in thickness to be preferred to the thin burglar tape used by Kotkis,[4] as there is no danger of its tearing when it is being applied, yet it is sufficiently flexible to make firm contact and strong enough that it may be used many times. A metal clip is attached by a connecting cord to the distal end of the foil and to the positive pole of the galvanic generator. To prevent concentration of the current at the point of entry it is essential that a small piece of rubber sheeting be placed under the clip. To prevent drying of the paper and to insure close contact, the entire hand is then covered with a non-absorbent pure gum rubber bandage. Because of its elasticity, care must be exercised in applying the bandage so that it is not applied too tightly. By including the clip in the bandage there is no danger of the

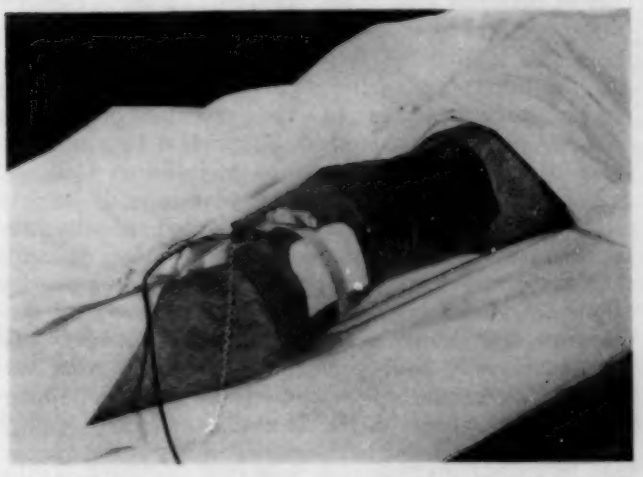

Fig. 4

patient loosening the connection if he moves his hand. (See Fig. 4, showing bandage as applied to the knee.)

Before applying the electrodes, the skin areas should be examined carefully and any break in the skin, including acne pustules, no matter how small, should be covered with adhesive tape only sufficiently large to cover the abrasion. Collodion may be used in a similar manner. The resistance to the current at these points is lower, making an easier port of entry. Since the current would take the course of least resistance it would concentrate there and cause burns. This type of burn is usually deep and slow to heal.

After the electrodes have been applied and connected with the machine, the active with the positive pole and the dispersive with the negative pole, all connections in the set-up should be checked to be certain

they are tight in order to prevent any danger of sudden break in the currents by slight movement of the patient or the machine. (This would cause a shock to the patient.) The current is now turned on very slowly and increased gradually to the desired milliamperage. Thirty to 40 milliamperes of current on the hand and 40 to 50 milliamperes on the larger areas was found to be within the average patient's skin tolerance. The length of the treatment is 20 minutes of maximum milliamperage. At the end of the treatment the current is slowly turned off, the electrodes removed and the parts carefully examined for any evidence of possible injury. The patient should remain quiet for 20 or 30 minutes following treatment.

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*Fig. 1 printed with permission from "Annals of Internal Medicine," Vol. 10, No. 6, December 1936.

Recent Ideas About the Prevention of Infantile Paralysis

W. Lloyd Aycock, M. D.

For the purposes of this discussion, let us consider the control of poliomyelitis under four headings: (1) the cure of paralysis after it has occurred; (2 the prevention of the one serious consequence of the disease, paralysis: these two approaches constituting therapeutic control; (3) the prevention of the occurrence of the disease by precautionary measures; (4) the prevention of paralysis by some prophylactic method, although it may not necessarily prevent the occurrence of the infection itself.

As you know, not so many years ago, before the after-care of poliomyelitis was developed, an attack of the disease was likely to result in far more disability than at the present time, perhaps largely because of what might be called secondary crippling, the results of contractures and deformities. But orthopedic surgery and physical therapy have gone far to eliminate what was formerly a common sight—a miserably deformed youngster hobbling about on the floor like a frog. Although after-care has gone far to lessen the effects of the disease, to maintain muscle strength and balance and to enable these patients to carry on in the ordinary walks of life to a great extent, in the strict sense of the word paralysis itself has not been cured. From the very nature of the lesion—the death of nerve cells—we know that we can hardly look for a cure.

It has long been known that one attack of poliomyelitis, both in the human and in the experimental animal, affords a lasting immunity. This is indicated by the infrequency of second occurrences in the same individual, and further shown by the fact that the blood serum of a convalescent possesses the property of destroying the virus in the test tube. The supposition that the virus would likewise be destroyed in the body led to the use of convalescent serum in the treatment of cases of the disease. For a number of years, probably because of the scarcity of serum, it was reserved largely for the desperate cases and the results were inconclusive. Later it was felt that beneficial effects could hardly be expected after paralysis had occurred, and the use of this therapeutic measure was therefore recommended in the early stages of the disease, before paralysis had set in, with the hope that it might be prevented. At this time little was known of the frequency of the occurrence of milder, non-paralytic forms of the disease because of the fact that most cases were diagnosed only after paralysis had set in. However, it was realized that, in the majority of cases at least, paralysis was preceded by a definite train of symptoms which were diagnostic.

In Massachusetts, in 1927, an attempt was made to ascertain the value of convalescent serum administered in the preparalytic stage of the disease, which usually lasts about three days. At the outset, it was realized that there would be difficulty in predicting the severity of the cases, since none of the symptoms give any indication as to the extent of severity of the paralysis to follow. It was thought that some cases would prefer serum and that others would not, and so some comparison could be made between treated and untreated cases; but no one refused serum. The result was that at the end of the outbreak a large number of cases had been diagnosed during the preparalytic stage and given serum. Such a large percentage of these cases recovered without paralysis that it was believed the serum actually had prevented it in the majority of these cases, although it was not known to what extent these apparent results might be affected by the inclusion, among the treated cases, of patients with mild forms of the disease who would not have developed paralysis.

It was not until 1931, when doubts arose as to the efficacy of serum, that an opportunity was afforded for treating one-half of the cases diagnosed in the preparalytic stage and reserving the remainder for control. When this was done, it was found that there was no difference

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in the outcome between treated and untreated cases. This result proved that the apparent beneficial effects of serum were due in reality to the diagnosis of mild, non-paralytic forms of the disease which in the past had been missed.

We may therefore concede the inefficacy of the one therapeutic agent which, from both experimental and theoretical considerations, was believed to hold some prospect of preventing or lessening paralysis when administered in the early stages of the disease. Although the question of the therapeutic control of paralysis cannot be considered a closed chapter, there is not a hopeful remedy in sight. We therefore turn to the third topic to be discussed; namely, the prevention of the occurrence of the disease altogether, by sanitary measures or immunization. Any consideration of the probability of success as well as the practicability of such measures must be based upon a knowledge of the epidemiology of poliomyelitis.

It is unnecessary to review the evidence which has established poliomyelitis as an infectious disease due to a filterable virus. Earlier epidemiologic studies, which took into consideration only paralytic cases and attempted to trace the infection from one to the next, failed to reveal the mode of spread of the infectious agent, and it was only when the preponderance of mild abortive or subclinical infections were recognized that the mode of spread became apparent. Further, through studies of certain general characteristics of the disease—its age distribution and other immunological features—it has been shown that, in spite of the relatively low incidence of the paralytic disease, a large proportion of individuals who are at some time exposed to the virus, failing to develop apparent symptoms, attain an immunity which is detectable by test; and thus the concept of widespread distribution of the virus has been evolved. According to the evidence, the extent to which the virus spreads, the rapidity of its dissemination through a population, and certain variations in the rate of spread—e. g., in urban as compared with rural populations—have demonstrated with reasonable conclusiveness that the virus of poliomyelitis must be spread from person to person in much the same manner and with the same facility as the viruses of some of the more common infectious diseases like measles, scarlet fever and diphtheria. The essential difference between poliomyelitis and these other infections would seem to lie, not so much in any difference in the extent and rapidity of spread of the virus, but rather in the infrequency with which exposure results in the recognizable disease rather than the subclinical form of the infection. It can be seen at once that if the infectious agent of poliomyelitis is spread largely through individuals not identified as carriers, any attempt to prevent its dissemination by isolation of these persons is not likely to succeed. This does not mean, of course, that the relatively small percentage of known carriers should not be isolated as a matter of individual prophylaxis. To state it in other words, it would appear that the dissemination of the virus of poliomyelitis is a function of ordinary unavoidable and probably, to a large extent, irreducible human contact; and therefore an attempt to check its spread by the usual means is not likely to be successful. Thus the question of control by methods of immunization, so effective in certain other infectious diseases, came to be considered.

Since one attack of poliomyelitis protects against subsequent infection, and especially in view of the fact that in nature the virus is a highly effective immunizing agent, a method has long been sought for the artificial production of immunity, largely through attenuation of the virus to remove the risk of producing the disease itself. As yet no successful procedure has been devised, but many hope that prevention may be achieved in this manner. However, there are certain considerations which render it doubtful whether such an approach to the control of poliomyelitis would be feasible for application to the general population. There would be a certain hazard with any method, for the reason that immunization in virus diseases has been accomplished only with living virus, always with some risk of infection, and not with killed virus where such a possibility is removed. Furthermore, it would appear that only a small proportion of individuals really stand in need of protective measures; namely, the few who develop paralysis among the many who are exposed to the virus. This introduces the question as to whether or not the hazard of the vaccine might not too closely approximate the risk of the disease itself.

In consequence of the epidemiologic peculiarity of poliomyelitis just referred to; namely, that but a small proportion of those exposed to the virus (perhaps something like one in a thousand) stand in need of protection against the one serious consequence of the infection, paralysis, it can readily be seen that a given prophylactic measure which might be both effective and feasible for use in the small number who are susceptible might not be practical for general application. Epidemiologic studies indicate that the paralytic complication is determined not so much by any circumstance relating to exposure, such as virulence or dosage of virus, but rather by some inherent susceptibility which distinguishes the few from the majority who are inherently resistant to paralysis under the same circumstances of exposure. This conception suggests a new approach to the problem of the control of poliomyelitis, namely, a study of this inherent or autarceologic susceptibility. An understanding of the nature of this susceptibility might make possible a selection of that relatively small minority of susceptible individuals for the application of precautionary measures which would not be practical for general use.

Autarceologic susceptibility to poliomyelitis has not been clearly defined, but some of its features are beginning to be understood through clinical, epidemiologic and experimental studies. Clinical impressions have long indicated that the paralytic disease tends to occur in individuals of a type suggestive of some difference in physiologic make-up, not an abnormality in the usual sense of the word, but a variation which affects growth and development. Epidemiologically, autarceologic susceptibility appears sometimes to be a familial trait, and experimental investigations are throwing light on the nature of what might be called the physiologic fault which determines susceptibility to the paralytic form of the disease.

The important problem now is the study of autarceologic susceptibility: of its nature, in order to identify the susceptible minority; and of its mechanism with a view to applying to these individuals measures which might not be suitable to the population in general. We may hope for correction of the inherent physiologic fault, or a means of selection of susceptible individuals for whom prophylactic methods, such as immunization, may be feasible.

Minnesota's Services for Crippled Children

H. E. Hilleboe, M.D.,* and E. R. Harrison, R. N.**

Services for crippled children in Minnesota have been greatly augmented as a result of the allotment of Federal funds made possible by the Social Security Act. Provision for adequate medical care has become statewide in scope and has been extended to rural areas particularly, with the result that several different types of service are offered now which were not available before. The purpose of this discussion is to present briefly the problem of the crippled child in this state, and the method in which this problem is being attacked and solved by the official State Agency, the Minnesota State Board of Control through its Division of Services for Crippled Children.

Up to the present time, there has been no calendar census or complete registry of crippled children in Minnesota, so it is impossible to state accurately the actual number of children involved. However, estimates made on the basis of the number of cases taken care of at the in- and out-patient departments of the various hospitals in the state give the number of crippled children under twenty-one years of age as approximately 10,000. When the term "crippled child" is considered in its broadest sense, including non-orthopedic disabilities, this figure seems to be a fair estimate. From several surveys of crippled children, one including 3500 cases registered with a state bureau, the causes of the disabling conditions are distributed in percentages as follows: accidents, 11 percent; cerebro-spastics, 14 percent; arthritis, 2 percent; congenital deformities, 25 percent; anterior poliomyelitis, 20 percent; muscular dystrophy, 1 percent; osteomyelitis, 4 percent; rickets, 5 percent; scoliosis, 1 percent; tuberculosis of bone and joints, 3 percent; miscellaneous (non-orthopedic), 14 percent. A careful census of the children crippled by rheumatic heart disease will probably increase the miscellaneous group with a proportionate decrease in the relative proportions of the other groups.

Minnesota's population of 2,500,000 people is approximately 50 percent rural, and the 87 counties of the state have an area of 84,682 square miles. These factors added to the total number and types of disabilities give one a fair idea of the extent of the problem involved.

Fortunately, excellent hospital facilities for crippled children have been available for the past several years in Minnesota. Gillette State Hospital opened in 1914, and has given increasing amounts of service continuously up to and including the present time. There are 250 beds available at Gillette. The staff of the out-patient department examine about 400 patients per month. There has been no permanent field nursing service at Gillette State Hospital up until the new services became available this year.

The University Hospital has a 35-bed unit for the care of crippled children which has been functioning successfully for several years. This hospital has a small out-patient department, but no field nursing service. The Shriners Hospital for Crippled Children, located in Minneapolis, serves many of the neighboring states as well as Minnesota, so that only 10 to 15 beds are used for Minnesota children during the year.

In spite of the fact that 300 hospital beds were available for crippled children in the state, there has been a waiting list of 200 to 300 children at these hospitals for several years. The lack of convalescent and boarding homes, and the lack of funds to supply field nursing and social service workers, were important factors in the inability to cope with the problems presented in this state.

For several years, the Minnesota Public Health Association and the staff of the Gillette State Hospital have held orthopedic clinics in certain rural areas in an attempt to give field diagnostic and follow-up service. This cooperative work was of real value but could not be carried out in every part of the state, and a sufficient number of clinics could not be held year after year. Besides, no provision could be made for field follow-up, nursing, or physical therapy service, which is such a necessary part of any clinic program.

There was need then for extension and enlargement of services for crippled children if the problem was to be successfully met. In Minnesota, during the past few years, there has been an increasing awareness of the problems of the crippled child. Private organizations in many communities have attempted to cope with the situation but realized that the services they were able to give were very small in proportion to the number of children who needed care.

When Federal funds became available in the early part of 1936, Minnesota was in a highly receptive mood because the lack of funds was the only thing which had been obstructing the completion of plans for adequate state-wide medical care for the crippled child. The additional funds immediately removed this obstruction.

The extension of services was directed in three fields of endeavor: first, increased hospital facilities; second, increased field clinics; and third, field nursing and physical therapy services. This work was carried forward under the direction of the Minnesota State Board of Control, which also has supervision of the Gillette State Hospital for Crippled Children as well as all other state institutions.

The first service rendered was hospitalization of indigent crippled children on the waiting lists of the hospitals in the state. Arrangements were made with qualified physicians and approved private hospitals so that excellent medical care could be given at fees agreeable to everyone concerned. This service has continued uninterruptedly and has resulted in a marked reduction in the waiting lists and a decrease in the period of time new cases must wait for admission to hospitals for care. It is hoped that in the future the existing state facili-

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ties will be able to handle the current hospital load. When that time comes, this type of service will be discontinued.

Because of a late start this year, only eight field clinics have been held in rural areas. It is planned, hereafter, to hold twelve clinics annually which will be placed at strategic points throughout the state, so that residents of every rural county will have access to crippled children field clinics each year for diagnostic and follow-up examinations. These clinics are cooperative affairs with local, county, and state groups participating. An orthopedist, pediatrician, physical therapist, public health nurse, and a vocational rehabilitation expert, are in attendance at these clinics. The local school and county public health nurses assist in the clinics also. The publicity and health education associated with the clinics are handled by the Minnesota Public Health Association.

The successful operation of a field clinic is almost entirely dependent upon the proper preliminary work performed by the field staff. The routine procedure of running the clinic is simple, but the preparation for the clinic is an individual matter to be approached and handled carefully in each separate community. Cooperation and approval by the local medical society is essential. Proper follow-up after the clinic enhances the value of the clinic and makes it a service of permanent usefulness, particularly if it is repeated year after year in the same locality.

The eight clinics held this year made possible the examination of 719 crippled persons under twenty-one years of age. About 35 percent of these cases were new to the state register. Practically all of the new cases were referred to the clinic with a letter from the family physician. It is interesting that many of the family physicians accompany their patients to the clinic and are present during the examination of their own patients. Many of these physicians remain during the entire clinic period in order to benefit by the experience of observing the clinic specialist in the examination and disposition of crippled children and their problems. These clinics are proving to be of real value in the extension and improvement of services for crippled children in Minnesota.

Table I shows the distribution of clinic cases by diagnosis, age group, and sex. The patients were about equally distributed as to sex—53 percent were males and 47 percent females. Of the 719 cases examined, 2.4 percent (17) were under one year of age; 15.6 percent (112), one to four years; 22.4 percent (161), five to nine years; 33.9 percent (244), ten to fourteen years; 24.1 percent (173), fifteen to twenty years; and 1.7 percent (12) of unknown age. There is evident a definite preponderance of cases in the older age groups. It is interesting to note that there is practically the same distribution of cases by diagnosis in this clinic group as in the survey group quoted previously in this discussion. The classification of diagnoses used is an arbitrary one set up for crude grouping of types of cases. In our record system the Standard Classified Nomenclature of Disease is employed.

Table 2 presents the distribution of crippled children by diagnosis and recommendation made at the clinic examination. This includes both new and old cases. It is to be noted that hospitalization and out-patient care are recommended for 52.6 per cent (378) of the cases. No recommendations were made for 10 percent (172) of the cases. This group consisted of patients with chronic disabilities in which the maximum return of function had been obtained, or conditions in which no treatment was indicated. The miscellaneous group made up 19.8 percent (142) of the cases. Many of the recommendations in the group were: lifts on shoes, arches, repairs on braces, etc. The supervision of these patients automatically became the responsibility of the field nursing service, although specific recommendations had not been made to that department for nursing service on these cases.

The nursing service organized in July 1936, became the connecting link between the local community and the new official agency. The purposes of the service were stated in the rules and regulations as follows:

1. To help locate new cases.
2. To assist in the preparation for and conducting of diagnostic clinics.
3. To perform the actual work of physical therapy and to supervise the home treatments as outlined in each case by the attending physician.

TABLE 1. Distribution of Crippled Children by diagnosis, age group, and sex, for clinics in Minnesota: 1936.

SEX	MALE							FEMALE							
	Age Group					Un-		Under					Un-		Grand
DIAGNOSIS	Under 1	1-4	5-9	10-14	15-20	known	Total	1	1-4	5-9	10-14	15-20	known	Total	Total
Accidents	0	2	13	13	17	0	45	0	4	6	13	5	1	29	74
Cerebro-spastics	1	18	17	26	16	0	78	0	11	13	10	5	0	39	117
Arthritis	0	0	1	0	1	0	2	0	1	0	1	5	0	7	9
Congenital Deformities	6	26	21	21	11	2	87	4	19	20	26	15	1	85	172
Anterior Poliomyelitis	1	0	15	37	25	2	80	0	5	18	30	24	1	78	158
Muscular Dystrophy	0	0	2	4	0	0	6	0	1	1	0	2	0	4	10
Osteomyelitis	0	1	1	6	2	1	11	0	0	0	6	3	0	9	20
Rickets	0	5	2	0	1	0	8	0	8	1	1	0	0	10	18
Scoliosis	0	0	0	2	2	0	4	0	0	0	7	7	0	14	18
Tuberculosis of Bones and Joints	0	1	1	1	1	0	4	0	0	2	2	2	0	6	10
Miscellaneous (Non-orthopedic)	2	7	8	5	4	1	27	2	2	7	6	7	0	24	51
Unknown	0	0	7	13	8	2	30	1	2	5	14	10	0	32	62
TOTALS	10	60	88	128	88	8	382	7	53	73	116	85	3	337	719

TABLE 2. Distribution of Crippled Children by diagnosis and recommendations for clinics in Minnesota: 1936.

DIAGNOSIS	RECOMMENDATIONS						
	Hospital	*Out-Patient Department*	*Nursing Service*	*No Recommendation*	*State Institution*	*Miscellaneous*	*TOTAL*
Accidents	18	13	9	7	0	27	74
Cerebro-spastics	22	19	44	11	4	17	117
Arthritis	3	2	1	1	0	2	9
Congenital Deformities	44	44	24	21	0	39	172
Anterior Poliomyelitis	25	69	25	15	0	24	158
Muscular Dystrophy	1	3	4	2	0	0	10
Osteomyelitis	5	6	2	3	0	4	20
Rickets	7	3	3	1	0	4	18
Scoliosis	5	4	1	4	0	4	18
Tuberculosis of Bones and Joints	3	1	0	2	0	4	10
Miscellaneous (Non-orthopedic)	7	12	8	5	2	17	51
Unknown	6	56	0	0	0	0	62
TOTALS	146	232	121	72	6	142	719

To fulfill these purposes, it was necessary for the nurses to acquaint themselves with the local resources for crippled children and to cooperate with the interested people in the community in making services available to all crippled children in need of care.

A staff composed of a supervisor and six public health nurses was appointed to carry on the work of this part of the program. The supervisor and two of the nurses were trained physical therapists. After the state had been divided into four districts, the four nurses who were not trained in physical therapy were assigned one district each.

Report cards were made on all known cases of crippled children and proved to be of enormous help to the nurses when first contacts were made in the local communities. All the physicians were consulted before any attempt was made to investigate the cases. Many new patients were referred by the local physicians, and a great many new names were reported by members of local societies, ministers, priests, welfare groups, and local civic organizations.

Home visits were made on all indigent cases. Interesting data is being tabulated as a result of the nurses' visits. The patients have been divided into four large groups:

1. Patients who have had medical advice but have not carried out the treatment recommended.
2. Patients who at present are unable financially to continue their treatment, although they are under the care of private physicians.
3. Patients who have never had medical care for their disabilities.
4. Patients who have changed physicians at frequent intervals, finally resorting to promised cures given by non-medical practitioners.

With the approval of the family physician, the patient, in every instance, has been urged to have an examination by an orthopedic specialist either at a clinic, hospital, or out-patient department. Information is not available at the present time as to the number of patients who have responded as a result of the nurses' visits, but it is quite apparent that most of the families are eager to obtain help if it is available.

The physical therapy service is a specialized one which, although limited at the present time because of a lack of trained personnel, will become increasingly important in the state program. Each physical therapist has been assigned to two districts. Her responsibility is to follow up clinic and discharged hospital cases.

Table 2 shows that 16.8 percent (121) of th patients examined in the clinics were referred direct to the nursing service; 8.2 percent (59) of the to clinic cases were referred for physical therapy treatme alone.

To attempt to provide a physical therapy service o a state-wide basis with a limited staff requires an e tirely different type of procedure than is customari followed in urban communities. The distribution of th patients over widely scattered areas makes necessary carefully planned program in order that the cost of th service will not become prohibitive.

The present procedure is for the physical therapis to make home visits on all the patients who have be referred for care. When physical therapy treatment h been ordered, the exercises are explained and demo strated to a responsible member of the family. Two o three consecutive visits are made to assure the work that the treatment is understood by the family. The p tient is not seen again until the physical therapist retur to that territory, which means that a considerable perio may elapse between visits, yet the case remains unde supervisory control which would not be possible othe wise.

Although such an arrangement is not ideal, th results up to date have been most encouraging. Splen did cooperation has been obtained from the parents, an improvement in the patient's condition has been demo strated. Some of the patients simply cannot or will no return to out-patient departments for follow-up physica therapy, so that, in these instances, the physical therap services must be brought to the home if beneficial an permanent effects are to be obtained following the ori inal treatments.

The district nurse and the physical therapist hav an equal responsibility in the arrangement for and con ducting of the diagnostic clinics. The district nurse is i charge of the preliminary arrangements for establishin a clinic. It is through her that local committees ar formed which assume the responsibility for the clini set-up. The local committee secures volunteers to assis at the clinic, obtains donations of milk and food fo lunches for the children, and provides local funds fo the cost of X-rays on indigent patients.

The physical therapist acts as an interpreter to th parents for the orthopedic specialist at the clinic. Sh explains the physician's recommendations, instructs th parents how to fill out the application blanks for hos pitalization, and makes arrangements for follow-up visit

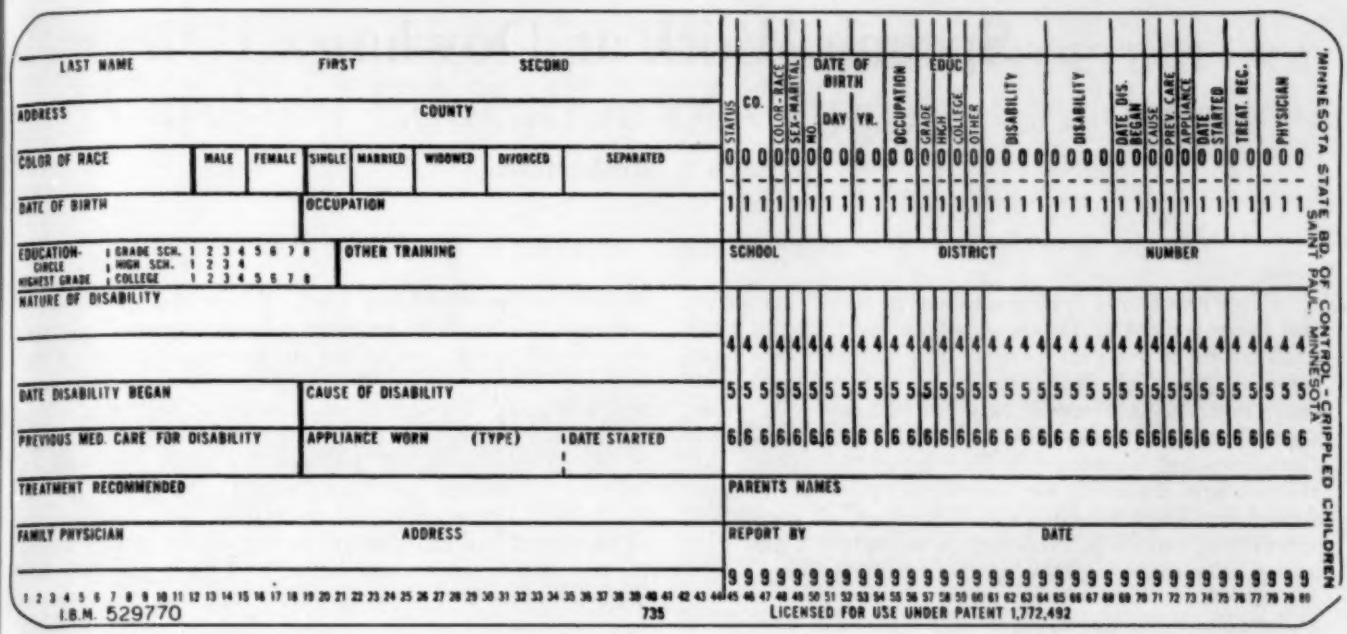


Fig. 1

on patients referred for physical therapy. Many home visits can be eliminated as a result of this service, and there is an indication that more cooperation is being obtained because the parents have a better understanding of what is being done.

When physical therapy treatment is recommended for post-operative cases, the patients are treated by private physical therapists during their period of hospitalization. A complete report is sent to the field physical therapist when the patient is discharged from the hospital, after which home visits are made in the same manner as used for the clinic cases.

Some of the cooperative activities carried on should be briefly mentioned. A central registration bureau has been set up under the Division of Services for Crippled Children. Every official and unofficial agency interested in the crippled child reports cases to this office. A sample of the report card used is shown in Figure I. All records are set up on punch cards. This facilitates collation of data and statistical analysis. Report cards of this type serve a dual purpose. They remain as permanent records, yet are punched, and are filed to be used as alphabetical and county files for procuring data on single cases, or for the purpose of detailed studies of thousands of cases in statistical analyses of distributions of interrelated factors.

All crippled children fourteen years of age and over are referred to the Division of Vocational Rehabilitation of the State Department of Education. Problems of transportation to and from schools are also referred to that department. The Department of Education also conducts a calendar census of all crippled children in the state school systems and reports all cases to the Division of Services for Crippled Children.

The Minnesota Public Health Association cooperates with the Division in all publicity and health education work. The Minnesota Association for Crippled Children and Disabled Adults assists in obtaining railroad passes for indigent crippled children whose parents cannot afford transportation to and from distant hospitals. The Coordinated Field Service of the State Board of Control assists the Division in social service in rural areas. It is planned to employ two medical social workers starting the first of January 1937, because the field work and increased hospital care has increased social service problems greatly. This will make possible greater use of approved convalescent and boarding homes for hospitalized cases.

Plans are being formulated, at the present time, for the creation of special classes for crippled children in rural areas throughout the state in conjunction with the regular school systems. The Division of Services for Crippled Children is assisting the State Department of Education in the medical aspects of the plan. Five special classes are contemplated to start with and this number will be increased as the need arises. These plans include one convalescent home for spastics where special teaching and training, as well as specialized medical care, will be available. The services of the out-patient speech clinic under the Department of Pediatrics of the University Hospital will be used to sort out the cases which can most likely be helped. One worker in this speech department is furnished by the Division of Services for Crippled Children in order that crippled children under our services may have access to this out-patient clinic facility. Harelip and cleft palate cases, and cerebrospastics especially, are referred to this clinic for examination of special senses and mentality. Speech problems associated with other crippling conditions are also referred here.

It is felt that provision for special education for certain crippled children who are unable to attend regular public school classes is very essential if rehabilitation of the crippled child is to be complete. Education and vocational training are fully as important as correction of physical or anatomical defects.

With the specific functions set up under the Minnesota State Board of Control, and the coordinated activities which are being carried out at the present time, it can be said that adequate provision for medical care and social welfare has been made for crippled children on a state-wide scale. This comprehensive program would not have been possible without the assistance of the Social Security Act. The continued extension and improvement of these interrelated services, added to the excellent facilities already available, is the surest method of safeguarding the health and welfare of crippled children in Minnesota.

Speech Work at Dowling

Berneice R. Rutherford

This report and brief discussion of speech correction and improvement at Dowling School for Crippled Children covers a five-year period. For the first two years speech classes were held two days a week; for the next year, three days a week; and for the last two years, approximately four days a week. Many types of physical disabilities are included. In this report the speech disabilities are classified, for simplicity, into two groups: articulation (which includes, in this paper, all speech disorders that cannot be classified as stuttering), and stuttering. The following table gives the distribution:

CONDITIONS OF SPEECH AS LAST OBSERVED

Type of Disorder	Number of Cases		Number Corrected		Number Greatly Improved		Number Improved		Number Not Improved	
	B	G	B	G	B	G	B	G	B	B
Spastic										
Articulation	25	30	5	7	11	14	6	8	4	
Stutter	9	7	3	2	3	4	2	1	1	
Polio.										
Articulation	11	6	8	5	2	2				
Stutter	4	1	2	1	2					
Cardiac										
Articulation	3	4	1	2	2	2				
Stutter	4		2		1		1			
Other										
Articulation	17	6	12	2	5	3	1			
Stutter	3		2						1	
Bone Ataxia.										
Congenital Deformities.										
P.M.D.—Etc.										

It is evident that the largest number of articulatory disorders are in the spastic group. They range from mild sound substitutions to little or no speech. Some of these children walk, and some do not. Some feed and dress themselves; others require varying degrees of attention. Neither the corrected nor the greatly improved group of spastics are all mild cases; in fact, several of the more severe cases are among these groups. Those in the "Not Improved" group are new to the building.

The largest number of stutterers is also to be found in the spastic group. In fact, in the same cases, frequently both an articulation disorder and a stutter are present either constantly or intermittently. It has been interesting and instructive to observe that during the period of lack of established dominance, as indicated through ambivalent sidedness, the speech has not progressed; that in some cases work on the crippled side has precipitated stuttering, while discontinuance of work on that side (in the same cases) has again eliminated the stutter; that in some cases work on the crippled side has had no apparent effect upon speech.

Speech work has included a wide variety of activities. For the cases of articulation disorders, some tongue, lip and jaw exercises are used. Where the speech musculature is definitely involved in the "spastic" picture, tongue depressors are an aid in the manipulation of the tongue. Many devices for gaining more breath control are used. These include blowing of feathers, windmills, soap bubbles, and later an increasing prolongation of voiced expiration. It has been my belief that with an increase of cerebral dominance would come better speech. So in both articulation and stuttering cases many types of handwork are introduced. In the severe spastic cases, no pencil nor crayon can be held. Finger painting has been found to be a very favorable medium. As soon as free, uncramped motion is approximated, large unlined paper and large crayons or pencils are introduced. Gradually, over varying periods of time, this paper is reduced and widely spaced paper added. This paper, in turn, is ever so gradually reduced in size. At all times, freedom of movement is encouraged, and fatigue avoided.

Lately, a full time occupational therapist has been added to the staff. Many of the above and also additional activities are now being carried on under her very able direction. As there is cooperation in this department, so is there cooperation in the corrective gymnastics and physical therapy departments. For example, not only do these departments carry on the usual coordinational exercises, but if it seems advisable from a speech standpoint to stress one side, particularly where stuttering or no speech is involved, then those departments further aid the speech department.

One more word about cooperation. Anyone doing remedial work of any kind is fully aware of the need of the cooperation of principal, doctor, classroom teacher and parent. Without the parents' assistance, adequate history is impossible; without the understanding of the principal and insight of the doctor, the undertaking of research is of no avail; without the whole-hearted and active cooperation of the classroom teacher, physical therapist, corrective gymnastics teacher, and occupational therapist, the speech clinician cannot obtain satisfactory results. At Dowling we have further cooperation. This is in the lunchroom. Whenever it is requested, a child's place at table is set according to the sidedness training agreed upon, and the speech clinician frequently goes into the lunch room to give any necessary assistance to the child.

Recently another phase of speech work has been introduced at Dowling. This is dramatics. Most of these groups are free of speech defects. Dramatics is not being considered from the standpoint of developing any fine degree of acting, but we are using the mental hygiene of speech to lead the children toward fuller and happier living through ability to express themselves with freedom and ease. The principal aim is to give joy. We are hoping, however, that this group will be a leavening influence that, for instance, through development of a verse speaking choir (if this is possible), better articulation will become an accepted goal at Dowling.

Speech Clinician, Dowling School for Crippled Children, Minneapolis, Minnesota.

Recent Expansion in Wisconsin's Program for Care and Education of Crippled Children

Marguerite Lison Ingram

It was ten years ago that a state-wide movement was initiated in Wisconsin in an effort to provide adequate care and education for crippled children in this state. Previous to that time many organizations, such as Rotary, Kiwanis, Elks, Shriners, and various women's organizations had been interested in the care of individual children, but not until 1926 had there been any state-wide approach to this problem.

Previous to the passage of the crippled children law in 1927, a study was made in four representative counties in order to obtain a definite idea of the existing needs in the matter of care and education for the group of crippled children under twenty-one years of age. As a result of that study, some very definite conditions and needs were disclosed.

It was found that some of the children had been fortunate enough to have had proper medical care consistently followed over a long period of time, and, consequently, the resulting disability from their orthopedic condition had been minimized. Another group had had adequate hospital care at the outset but had lost, at least in part, the benefit of such care through failure to follow recommendations made on discharge from the hospital in regard to braces, home care, and re-examination. Another group of children had been taken from one doctor to another, not remaining long under the care of any one physician, and eventually discontinuing medical supervision entirely because of discouragement. It was also found that a number of children had been unable to attend school at all because they could not walk or climb stairs. Other children were able to attend school only during the spring and fall, it being necessary that they remain at home during the winter months because of the danger of slipping on icy walks, or because of their inability to stand the severe cold. Another group of children had lost from one to five years in their academic program because of frequent or prolonged periods of hospitalization.

The Crippled Children's Bill which was passed in August 1927, was an attempt to fill some of the gaps in the follow-up care and educational program for crippled children. After the passage of this bill, the Crippled Children Division was created in the State Department of Public Instruction. This division was to have supervision of the physical care of all crippled children up to the age of twenty-one years, and of the educational program for crippled children during the time they were attending elementary or high schools.

There have been certain definite guiding principles which have influenced the development of the program for care and education of crippled children in this state. *First*, that all efforts in behalf of crippled children should be primarily directed toward the prevention, correction or minimizing of disability. *Second*, that children with physical disabilities should be given opportunity to obtain as far as is possible an uninterrupted education, as well as an adequate education. *Third*, that opportunity for care and education should be equally available to children of rural areas and urban centers.

Since the establishment of a state-wide program for crippled children in Wisconsin, all legislation has been directed along these lines, and the results, in most instances, have proved to be very satisfactory.

With the idea in mind that all children having an orthopedic defect should, as far as possible, have this defect corrected, orthopedic schools have been established in this state. Each of these schools has both an academic and a physical therapy department. The physical therapy department is staffed by individuals who have had physical therapy training in accordance with the stipulations of the American Physiotherapy Association and the American Medical Association. Nearly all the individuals employed in this capacity have also had previous experience in various orthopedic hospitals.

These orthopedic schools have been established to provide physical therapy for children having medical prescription for such care. Each child enrolled or granted service through the orthopedic schools is admitted upon the recommendation of a physician and remains under orthopedic school supervision until his physician feels a maximum amount of improvement has been obtained.

Orthopedic schools have also been designed to meet the needs of the group of children who may not necessarily require physical therapy but who are so handicapped that they are unable to attend a regular school. To meet the needs of this group, the buildings in which the orthopedic schools are conducted are especially adapted to the needs of a crippled child, in that ramps are installed in place of stairways, and railings are placed along the hallways and around the classrooms to help the children who may have difficulty in walking. Children are transported from their homes to these schools either by bus or taxi. Noon luncheon is provided and adequate rest room facilities are made available to these children according to their individual needs. It was found during the past year that only one-sixth of the total enrollment of the orthopedic schools attended these schools because it was physically impossible for them to attend any other type of school.

Because of the fact that fifty percent of the population in Wisconsin resides in rural areas or villages of less than 2,500 population, legislative provision has been made in order to grant aid for maintenance costs for those children having to board away from home in order to attend an orthopedic school. With the appropriation granted the Crippled Children Division, eight schools were established previous to March 1936, and before that date approximately 650 children were served annually through these schools.

The children attending the orthopedic schools in Wisconsin attend only as long as their physical improvement continues. Children are admitted to the orthopedic

Director, Crippled Children Division, State Department of Public Instruction, Madison, Wisconsin.

schools on medical recommendation and are dismissed on medical recommendation. The turnover is large, approximately one-third of the children being returned each year to their regular local schools, having secured a maximum amount of benefit from the care given in the orthopedic school.

With the passage of the Social Security Act and the subsequent funds which were made available to this state, it has been possible to establish two more orthopedic schools and to enlarge the eight schools previously in operation in order to accommodate a larger number of children.

Previous to this year, owing to the very limited staff and the large amount of work involved, it has not been possible to offer any appreciable amount of field service through this division. However, with the assistance available through federal funds under the Social Security Act, it has been possible to establish a field service through this division to assist families and physicians in arranging for care which might be desirable for crippled children throughout the state. While the field service is still very inadequate because of limited personnel, we have been fortunate in obtaining the services of three physical therapists who, because they have been employed in this state for some years, are familiar with the general plan for crippled children services in operation at present.

These three field workers are able, through training and experience, to afford considerable assistance to families and physicians. Through home supervision of recent cases of poliomyelitis, it has been possible for the field workers, under the direction of the local physicians, to institute early care for the prevention of deformities and a subsequent muscle training program in the home before orthopedic school attendance is desirable. Through the activity of the field staff it has also been possible to instruct parents in corrective measures for the preschool child and the school age child with minor defect, if the place of residence of the family is far removed from an orthopedic school. Since the establishment of the field service, there has been a constantly increasing demand on the part of the medical profession for this type of assistance.

Orthopedic clinics which were conducted in Wisconsin previous to 1936 were financed through private funds raised by lay organizations. It was found, however, that as the clinic program became more extensive and medical problems more involved, it became increasingly difficult to conduct such a program through private funds. With additional public funds, which have been made available for clinic expenses, it has been possible during the past year for the Crippled Children Division to pay clinic costs and to plan clinics according to community needs and in close cooperation with the local medical societies.

Because so much of the program of the Crippled Children Division is medical in nature, this Division requested of the State Medical Society the appointment of a medical advisory committee. This State Medical Advisory Committee has been functioning for the past year and a half and has given invaluable assistance to the Crippled Children Division through its advice regarding medical policies and procedures.

As a means of securing further advisory assistance from the medical profession, county medical societies have been asked to appoint similar advisory committees to assist the local orthopedic schools in their problems. All of these committees are now functioning and are rendering very helpful assistance to the physical therapy departments of the orthopedic schools in this state.

At present a unique program is being jointly sponsored by the Crippled Children Division of the State Department of Public Instruction, and the State Medical Society of Wisconsin. A meeting is being held in each of the thirteen councilor districts of the state on the subject "Prevention of Disability." These meetings have been arranged through the office of the State Medical Society. The presiding officer in each instance is the councilor representing that councilor district.

Each district meeting opens at 2:30 P. M. and continues through afternoon, dinner and evening sessions. The speakers on the program include two orthopedists, a pediatrician, a cardiologist, the Secretary of the State Medical Society, and the Director of the Crippled Children Division. The program presented at each meeting has included papers on the following topics, followed by general discussion:

Explanation of the State Program for Care and Education of Crippled Children
Director of the Crippled Children Division
Fractures of the Elbow in Children
An Orthopedist
Prevention Through Periodic Observation
A Pediatrician
Acute Osteomyelitis in Children
An Orthopedist
Relationship of Rheumatic Fever and Heart Disease
A Cardiologist
Address by Secretary of the State Medical Society
Early Diagnosis and Medical Treatment of Infantile Paralysis
A Pediatrician
Prevention of Disabilities in Infantile Paralysis
An Orthopedist

The meetings, without exception, have been received by the medical profession with enthusiasm. The program which has been presented has served to more clearly inform the medical profession of the facilities and services available to crippled children of this state. It has also served to emphasize the necessity of the medical profession assuming the responsibility of leadership and advice in the field of medical care and prevention.

John Wesley (1703-1791), who left the Church of England in disgust so that he could bring religion to the poor, wrote a book on "Primitive Physick." He recommended cold bathing, and breathing into a hole cut in the fresh earth as cures for consumption.—*Clio Medica XVI, "Tuberculosis" by Gerald B. Webb, M. D.*

Re-education of Relaxation

John H. C. Colson

Of all the numerous factors which are grouped under the main title of physiotherapy, there is none so important and yet in practice so inadequately treated, as relaxation. And this, despite the fact that its use is a daily occurrence, whether it plays the part of an adjunct to another treatment, as for instance in general massage of the body, or forms one of the primary curative agents, as is evident in neurasthenia.

In the main, the average technique consists of *suggesting* repose to the patient, and relying on his own individual power of relaxation. While this may be found successful in some few cases, in the majority it will but partially attain its object, and fresh instruction has usually to be given at each treatment. Not only this, but the ultimate results are rarely satisfactory.

In order to produce the best possible effect, a totally different plan of action is indicated. It is not enough to rely upon the normal perception alone, for it has been dulled by modern civilization, with its overmechanized, restricting influence on Nature's natural efforts. The whole process needs re-educating, until relaxation becomes completely under control. In securing this, we must go farther than merely indicating the correct sense, and provide the individual concerned with a definite, concrete method whereby he can not only regain the power, but practice it by himself until it becomes an every-day entity.

The most successful and simplest technique which can can be employed for this purpose, is to teach the patient a series of especially designed exercises, which for want of a better name I have called the Overtension Relaxation Movements. If these are carried out and combined with the other factors instanced here, not only will relaxation be perfectly re-educated, but in a short time will be quite accessible without any preliminaries whatever.

The Technique of Repose

One of the greatest advantages of this method is that practically no preparation is needed. All that is necessary is for the patient to adopt the fundamental lying position on an ordinary plinth—for practice purposes at home a bed can be utilized—with pillows arranged so as to support the arms in their entire length, and to slightly flex both the knees and the head, in order to minimize muscular tension.

If relaxation is being carried out at night, a dark blue shade should be used to dim the light; if on the other hand it is day-time, the windows should be screened so as to darken the room, and again preferably the material should be of a blue color.

Then before the actual relaxation movements are carried out, an attempt should be made to convey the sense of repose to the patient. No mention of relaxation is made, however; it is suggested, rather than definitely indicated. Remind him of that last occasion when the body was fatigued and weary from some strenuous effort —that last long tramp, with home seeming too far ever to be reached again—when every muscle of the body ached for the touch of cool sheets and the sublime comfort of bed. As he thinks of it, bring back recollections of that limp, lead-like feeling of his limbs, and the intangible sensation of giving up his entire weight to the plinth or bed.

The Overtension Movements

Deep breathing is now performed for a few minutes, before the actual relaxation is commenced. On its termination the series of re-educational movements should be carried out, each individual exercise being repeated four times in succession. In particular, it is of vital importance that the movements should be taken to their fullest possible extent, and the working muscles strongly overtensed, as it is on this factor that success depends.

The arms are treated first, both elbows being flexed as much as possible; overtension is then complied with, the patient being instructed to attempt to bring the whole of the anterior surfaces of the arms and forearms together. The position is then maintained, the forearms being allowed after a few seconds to slowly return to their normal position.

After this has been repeated three times more, the wrists are similarly treated. The patient is instructed to hyperextend them with the fingers straight and rigid, to overtense the performing muscles, and then as before gradually to slacken them off. Following this the opposite action is carried out, both wrists and fingers being fully flexed, and the same method applied.

The legs should now be exercised, the first movement consisting of drawing up the knees with the heels resting on the surface of the plinth, until the hips are fully flexed and the movement cannot be taken any further. The succeeding overtension is then relinquished, and the legs replaced in their original position by a reversal of the former action.

At the finish of this set of movements, the ankles are dealt with in exactly the same manner as were the wrists. First the feet are dorsi-flexed, and secondly planter-flexed, both movements being carried to their fullest possible extent. Following this, the knees are hyperextended and the legs pressed firmly together until the adductor muscles cannot be further overtensed, after which they are relaxed off and allowed to roll gently apart.

Then from the lying position the trunk is alternately side-flexed, eight times in all, maintaining the greatest possible degree of movement. The patient should be instructed to touch the ankles with the tips of his fingers, and to obtain the maximum muscular overtension by slight rebounds of movement.

Reprinted from The Journal of the Chartered Society of Massage and Medical Gymnastics, September 1936.

The series of exercises then terminates with the patient "screwing" up the facial muscles, and at the same time pressing back the head firmly into the pillow, carefully observing the same principles as have governed the previous actions. Deep breathing is then again carried out, and at its conclusion if the technique has been adequately performed relaxation will be definitely induced throughout the body. For success, if it is to become the purely natural function that Nature intended, the movements should be practiced daily until the patient can definitely relax at will, independent of circumstances and time.

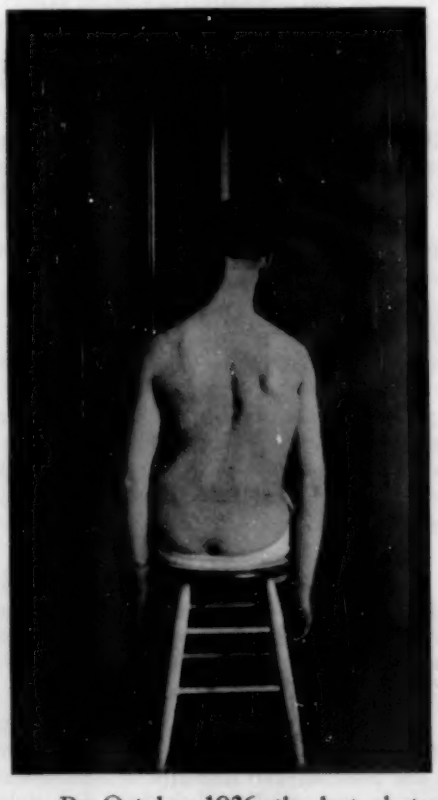
Scoliosis

A Report of a Case

Gudrun Brask

The following is a short case report given mainly to show the value and importance of having the patient's cooperation:

A boy, 15 years old, with a marked C-type scoliosis involving most of the dorsal and part of the upper lumbar spine with compensatory cervical curve, and no lower lumbar compensation. There was no history obtainable. The back had not been treated, the curve had "just been noticed." There seemed to be no muscular paralysis, but neither was there any muscle power. He showed poor muscular development and marked loss of muscle tone. The spine was very flexible although there was considerable limitation of side-bending towards the right. The boy was born in Japan to American parents, and there might have been question of malnourishment and rickets, but no Roentgen ray was taken and the diagnosis was ideopathic scoliosis.



The patient was from out of town—a distance of about one hundred miles. In order that he might report for treatment it was arranged for him to stay with friends for a period of two weeks. During this period he had twelve treatments consisting of instruction regarding exercises to be done daily at home. Also, a scoliosis brace of the ordinary type with elastic band pressure over lower right rib area was fitted.

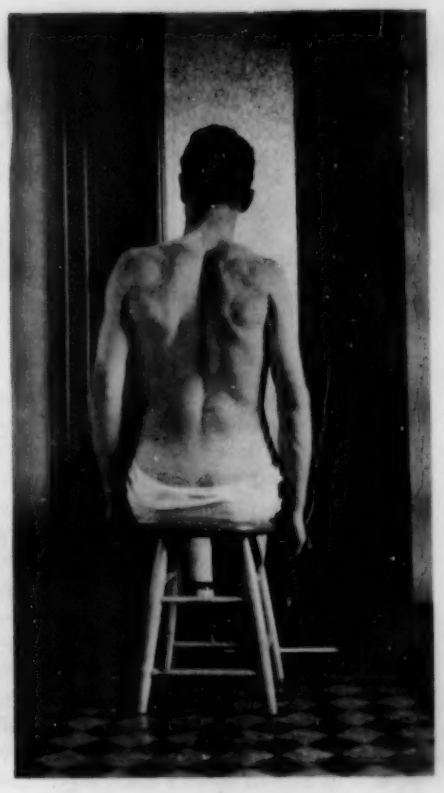
The boy then went home and between April and October he had four additional treatments, at which times instruction was given regarding the exercises, and new ones added. During this time he continued wearing the brace and removed it only while exercising. He then moved to a distance of about 175 miles from the city, and we did not see him again until five months later, in March 1935. He was showing constant gain in correction and muscle power. He reported every other month, and in November 1935 was advised to gradually discard the brace. This was carried out, and by April 1936, he was wearing it only when doing heavy lifting or other hard work. There seemed to be an entirely satisfactory correction, very little disalignment, and ample muscle power to hold.

By October 1936, the last photographs were taken, and it was gratifying to see what had been accomplished by twenty-five treatments over a period of two and one-

1022 Medical and Dental Building, Seattle, Wash.

half years and the earnest cooperation of the patient.

Results are shown by the recent back examination, and by the photographs, all four of which are taken in the patient's natural, relaxed position; two of them in April 1934, and two in October 1936. Other photographs in "shift" and crawling positions showed interesting results.



Examination, April 1934

1. Kyphosis: none.
2. Lordosis: none.
3. Waist-line: angle: left sharp. Skin-fold running from apex of left scapula to left waist-line.
4. Arms in relation to hips: right arm one and one-half inches from hip, left arm overhanging crest of ilium.
5. Crests of ilium: lett one-half inch high.
6. Length of legs: same.
7. Torsion of pelvis; left anterior iliac spine two inches in front of right.
8. Position of scapulae: right marked tilting. Distance of apex from spine: left two and one-half inches, right three and one-half inches from spinus processes.
9. Torsion of dorsal spine: Rather marked and some rib deformity.
10. Twist of upper trunk: Left shoulder held three inches in front of right.
11. Torsion in lower lumbar region: very slight.
12. Spinus process line: Plumb-line runs in line with left ear, sterno-cleido, apex of left scapula and through center of sacrum. The seventh cervical vertebra falls one and one-half inches to the right of gluteal crease.

Examination, October 1936

1. Kyphosis: none.
2. Lordosis: none.
3. Waist-line: angle: left slightly more acute than right.
4. Arms in relation to hips: Both arms hanging free of crests of the ilium.
5. Heights of crests of ilium: even.
6. Length of legs: same.
7. Torsion of pelvis: none.
8. Position of scapulae: well adducted.
9. Torsion of dorsal spine: Slight to the right in lower dorsal region.
10. Twist of upper trunk: Shoulders now in the same plane.
11. Spinus process line: Seventh cervical vertebra falls one-half inch to the right of gluteal crease, but right between ankle joints.

To succeed you must know your subject, and this means study. Study of text-books certainly. But even in your undergraduate days you should learn the supreme value of monographs, original articles, current medical and other scientific journals. Only in this way can you be trained in the ability to judge for yourselves the value of what is written, to distinguish fact from theory, hypothesis, or the mere guess—and not a little that is in print is of this latter character. "To know by heart is simply not to know. Let the boy examine and sift everything he reads, and take nothing on trust or authority," said Montaigne more than three hundred years ago. Yes, such ideas, though old, will stand repetition.

So read the promising new, the approved classics of the past. Read by cases, by subjects, e. g., diseases of the blood or of the bone. If attracted by any one subject, read exhaustively and ponder over it. You will acquire in this way a sense of mastery. You will learn the meaning of thoroughness. A thin spread of knowledge of a great many things spells mediocrity. The mediocre man is the dangerous man in the community. He does not know the limitations of his own knowledge or those of others, the risks of operation or of drug, the healing power of nature. Book knowledge is indispensable. It means work and more work in the library. And blessed result of it all, such work becomes your daily joy.

. . . The bedside in the home or the hospital is the laboratory where, by experience, you acquire knowledge and learn how to apply it. . . . Welcome the opportunity or compulsion to teach. No man is aware of what he knows or believes until he has tried to tell some one else about it or to write it down.—*From "The Chinese Medical Journal." The George W. Gay lecture on "Medical Ethics," delivered before medical students of Harvard University, November 7, 1935, by James B. Herrick, M. D.*

The New Swimming Pool and Therapeutic Center at Dowling School, Minneapolis, Minnesota

Gladys M. McAlister

February 28, 1936, will go down in the annals of Dowling School as a red letter day, for it was at that time that the first shovelful of earth was turned for the new swimming pool and therapeutic center. Since then the work has progressed steadily, and its completion is awaited eagerly by pupils, teachers, parents, and friends of the school.

The Michael Dowling School for Crippled Children is a one-story brick building, located on a wooded lot comprising twenty-one acres on the west bank of the Mississippi River. This building, which was erected in 1924, bciongs to the Minneapolis Public School system and is one of the elementary schools of the city. To this school two hundred twenty-five pupils are transported in school busses each day. One hundred seventy-five are orthopedic cases and the remaining fifty are cardiacs. Infantile paralysis and spastic paralysis rank highest among the orthopedic disabilities.

Training is provided for pupils from kindergarten through the eighth grade. The academic program is similar to that given in other elementary schools of the city since the same curriculum is followed.

In the therapeutic department, treatments or corrective exercises are given according to the recommendation of the school physician or the physician in charge of the case. The personnel of this department includes one physical therapist, two teachers of corrective physical education, one occupational therapist, and a speech clinician.

For ten years a small tank 9 ft. x 6 ft. x 4½ ft. has been in use for under-water exercises. This tank, which has proved a boon to many children, has at the same time been inadequate in meeting the demands of an increased enrollment and in accommodating the larger pupils. Because of its small size, swimming has been impossible. A new pool was needed if the boys and girls were to derive the benefits of relaxation, recreation, and general coordination which swimming affords. For this purpose $55,172 was secured from the Federal government and from the local Board of Estimate and Taxation $30,000 was obtained to provide more adequate treatment rooms and a corrective gymnasium.

The new therapeutic addition which is 80 ft. by 104 ft. will house the swimming pool, showers, dressing rooms, a drying room, a spectators' room, a doctor's office, instructors' offices, treatment rooms, a gymnasium for corrective work, and corridors. The design of the swimming pool and its operating equipment have been made to comply with the requirements of the Minnesota Department of Health. The pool which is 20 ft. by 60 ft. is ell shaped, the ell being 10 ft. by 20 ft. In this section will be two submerged treatment tables for use in under-water exercises. A stretcher hung on an overhead trolley will be used in transporting in and out of the pool the children who are unable to walk. The water will be kept at a temperature of 92 degrees.

Besides the regular under-water exercises given to strengthen weak muscles, there will be instruction in swimming for its recreational as well as its therapeutic value. All orthopedic pupils, having the doctor's permission, will be scheduled for swimming once each week under the supervision of one of the teachers of corrective physical education.

Overlooking the pool is a spectators' room which also serves as a waiting room for the doctor's office. In this room, visitors may observe the treatments and swimming activities of the pupils. The treatment rooms and the corrective gymnasium are located across the corridor from the swimming pool. The treatment rooms are equipped with numerous cubicles for individual treatments, muscle training, posture training, baking, massage and corrective walking. Opening off the treatment rooms is the corrective gymnasium for both individual and group work. Classes in coordination and rhythm will be held and the children will participate in corrective games.

Minneapolis may well be proud of this fine new therapeutic center at Dowling School and this further extension of privilege and opportunity to the handicapped children of the city.

In October, the pupils of Dowling School had the rare privilege of receiving a visit from President Roosevelt and Mrs. Roosevelt. The President, who had come to inspect the pool which had received his personal approval, said in his talk to the children, "I hope that all of you will be able to learn to swim in this fine pool. Swimming, you know, is the only exercise I can take. You will like it."

We feel certain that President Roosevelt's hope will be realized and that the pool will pay large dividends in bringing health and happiness to many handicapped boys and girls.

Principal, Dowling School, Minneapolis, Minnesota.

The Treatment of Congenital Torticollis Following Surgery

J. Irving Tuell, M. D.

The treatment usually accepted in this country for congenital torticollis of moderate or severe grade is either open or closed severance of the contracted, fibrotic sternomastoid muscle followed by immobilization in the position of complete over-correction of the deformity in plaster of Paris or other surgical appliance. This retention apparatus is left on for varied periods, but six weeks can be given as an average duration of immobilization.

When the curass is removed at the end of six weeks it is usually found that the neck muscles have become so weakened that the child experiences difficulty in holding his head erect. It is also often noted that the previously normal sternomastoid muscle has become so contracted from having been placed continuously in the position of maximum shortening for this period, that what previously may have been a right torticollis now simulates a left, or vica versa. It often takes several weeks, and occasionally several months, of diligent exercise to restore normal function to the previously normal muscle.

The following brief case report suggests a variation in this procedure:

A girl, age 8 years, was operated upon for congenital torticollis. The sternal and clavicular heads of the sternomastoid were separated at their insertions and the contracted deep cervical fascia was severed. A plaster of Paris appliance was applied holding the head in complete over-correction. A fulminating wound infection due to the streptococcus hemolyticus developed within twelve hours of the operation. Because of the marked inflammatory edema with respiratory obstruction, the retention device was removed entirely. All sutures were removed and the child was placed in prone position with continuous hot wet compresses to the neck. The child held her head continuously in the original position of torticollis.

The infection responded rapidly to treatment and in ten days the temperature was normal, although some drainage continued. A plaster head-band and body cast were applied, connected with turnbuckles, and the position of the head was changed to one of complete over-correction of the deformity in the next two days.

Two weeks later active exercises of the neck muscles were begun, removing the retention for treatments and replacing afterwards. Approximately five weeks after the operation all retention was discarded. A secondary closure of the wound was done for cosmetic purposes. After two weeks of supervised active exercises, motion of the head was essentially normal in all directions.

Due to a severe complication, a poor result was anticipated, but excepting a slightly broader scar than usual, an exceptionally fine recovery occurred in at least as short a time as in the uncomplicated case. The value of the prevention of muscle atrophy and shortening during enforced immobilization is re-emphasized. It is felt that this principle can have wider usage in the treatment of the uncomplicated case, to the advantage of the patient and physician, in patients old enough to cooperate.

In order to minimize the duration of convalescence, and to avoid the occasional case of persistent shortness of the previously normal muscle, the following regime is given, with of course no claim as to its originality:

Beginning a few days post-operatively, or as soon as the acuteness of the reaction to surgery has subsided, the child is taught active contraction of the normal as well as of the divided sternomastoid muscles and also the posterior cervical muscles. This should be a vigorous sustained contraction, actively forcing the head against the resistance of the snugly fitting plaster curass. The exercise may be compared with the static contraction of the quadriceps muscle used to maintain muscle tone while the knee is immobilized in a cast.

In two and a half to three weeks post-operatively the wound is almost healed, excepting for the contraction of the newly-formed scar tissue. At this time the curass may be bivalved and removed daily for active and assistive exercise of the neck muscles through their full range of motion. The retention apparatus should be replaced after each treatment, placing the head in the original position of full over-correction. The static exercises within the retention device are continued also throughout the remainder of the period of immobilization.

At the end of the six-week period all immobilization may be discarded, excepting perhaps a cotton collar which may be used as a mild support for a few days. Supervised active exercises should be continued until the range of motion is normal.

It is felt that the additional work involved in the maintenance of muscle function in the period of immobilization will be more than repaid by the shortened convalescence.

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You are a vital part of the American Physiotherapy Association but because of the fact that you are not organized into chapters, your contact with the national organization is not as alive as you would like it to be.

You undoubtedly have a great many things to contribute that would be of interest to other members of the organization.

Why not use the Review as your means of reaching them? Surely you have worked out some new points in technique, apparatus, or organization. Someone in your community most certainly has used new methods of treatment that would be of value to other physical therapists.

If you feel that you have derived benefit and interest from publications in the Review, do your bit by writing to the editorial staff and offering your cooperation.

1937 Convention

The sixteenth annual Convention of The American Physiotherapy Association is to be held in St. Paul, Minnesota, June 27, 28, 29, 30, and July 1. The Hotel Lowry will be our headquarters. Watch the REVIEW numbers for program highlights. Make plans now.

The Milwaukee group of the Wisconsin Chapter is having a course in anatomy and dissection conducted by Dr. Eben J. Carey and Mr. Walter Zeit of the Marquette University Medical School. This course is one of the projects of the Educational Committee of this chapter.

Elsewhere in this issue appears a review of the dissertation entitled "Residual Neuromuscular Hypertension: Implications for Education," by Miss Josephine E. Rathbone. This was submitted in partial fulfillment for the Degree of Doctor of Philosophy at Columbia University.

At the present time there is a very limited number of books on the technical aspects of physical therapy. The need for more complete and detailed information in book form is very definite.

Many members of the American Physiotherapy Association have had years of valuable experience and have accumulated considerable knowledge which should be made easily accessible. Others, even though their experience has extended over a shorter period of time, have nevertheless concentrated their efforts on some particular phase of the work and its problems, and they must have worthwhile information as a result of their specialization.

This excellent publication by Miss Rathbone should call forth the literary ability of the members of our association and should inspire them to make permanent contributions to the literature of their profession.

The First International Conference on Fever Therapy will hold its sessions on March 29, 30, and 31, 1937, at the College of Physicians and Surgeons, Columbia University, New York City.

WHAT KIND AM I?

What kind am I?
Am I an active member
The kind that's liked so well?
Or am I just contented
With the pin on my lapel?

Do I go out to meetings
And mingle with the flock?
Or do I stay at home
And criticise and knock?
Do I attend the meetings
And help the work along,
Or am I satisfied to be
The kind that just belong?

Do I ever visit members
Who are troubled, worn or sick
Or do I leave that to a few
Then crab about the "clique"?

I'd better think it over—
I know what's right or wrong.
Shall I be an active member
And not a just—"belong"?
Shall I go out to the meeting
And help with mind and heart—
Be a peppy active member
And take an active part?
What do you think?

MRS. M. V. THOMAS.
U. S. Veterans Bureau, Cleveland, Ohio.

ABSTRACTS

John S. Coulter, M. D.

Heating of Human Tissues by Short Wave Diathermy

By John S. Coulter, M. D., and Howard A. Carter, B. S. in M. E., Chicago, in Jour. A. M. A., 106:24: 2063, June 13, 1936.

In heating human tissues by short wave diathermy, claims have been made that certain wavelengths are more effective than others. A survey of current literature reveals many opinions. Apparently none of the authors have investigated the heating effects of different frequencies of short wave diathermy energy on living tissues of the human thigh. There are many references to heating of dead tissues and agar agar solutions.

Our investigation was undertaken because, apparently, there were no records in literature of heating living human tissues by short wave diathermy machines of different wavelengths. Therefore this study was made to determine the heating efficacy of short wave diathermy on living human fat and muscle of the thigh, employing first, an electric field of 6, 12, 18 and 24 meter wavelengths, using the cuff electrode technic; secondly, an electromagnetic field of 12, 18 and 24 meter wavelengths, using the coil technic. The cuff electrode of the electric field and the coil of the electromagnetic field were selected because previous work by Mortimer and Osborne showed these methods of application to be the most effective of those in general use for heating tissues.

The machine used in these tests was so designed that the oscillator circuit could be interchanged, thus giving the range of wavelengths aforementioned. Furthermore, arrangements were made for application by either electromagnetic or electric field technics. Temperatures were taken by three thermocouples made of copper and constantan wires (28-gage Leeds-Northrup double cotton covered), soldered into the tip of a 16 gage lumbar puncture needle. The thermocouples were connected to the potentiometer (Leeds-Northrup portable precision type) through parallel double pole switches, a method that facilitated rapid reading of the individual couple.

The thermocouples were calibrated against a Bureau of Standards calibrated thermometer with scale division in one-tenth degree Fahrenheit. Since the thermocouple itself was affected by the high frequency currents, there were no thermocouples in place in the field during the passage of the current.

The six human subjects were medical students who volunteered for these tests. Under aseptic precautions, a nonmagnetic nonconducting sheath (through which the thermocouple needle could be guided for temperature readings) was inserted subcutaneously and into the quadriceps extensor muscle. Temperatures of the skin, of the subcutaneous tissue, of the muscle and of the mouth were taken before and after a twenty-minute clinical application. The temperature of the patient was permitted to return to normal after each test.

The intensity of the current was governed by the patient's tolerance; that is to say, the subject agreed to stand as much of the current as was possible without suffering discomfort.

The size of the cuff was approximately 18 inches by 3 inches. One cuff was wrapped around the proximal part of the thigh and the other around the distal part of the thigh. The distance between the edges of the cuffs was about 6 to 8 inches. Under the cuffs, padding consisting of three thicknesses of felt and toweling was used. Under the four turns of coil there was one-half inch of felt padding.

Conclusion

In the heating of live human muscle and fat there were no significant differences in the use of 6, 12, 18 and 24 meter wavelengths when using the cuff technic of the electric field method, and no significant differences in the use of 12, 18 and 24 meter wavelengths when using the coil technic of the electromagnetic field method.

The Use and Abuse of Manipulative Surgery

A. S. Blundell Bankhart, F.R.C.S., Orthopedic Surgeon, Middlesex Hospital; in British M. J., No. 3947, Aug. 29, 1936; page 416.

People do not suffer from flatfoot but from inability to flatten their feet. The great majority of civilized people have acquired some restriction of the natural mobility of their feet, so that they cannot flatten without meeting with the resistance of the soft parts. When the flattening foot meets with this resistance it is strained, and the condition is painful. On the other hand, the completely flat foot is painless. The medical profession and the public have been obsessed with the idea of supporting the arch of the foot. In theory this is ridiculous, for the foot was meant to be an active supple member, and not a rigid thing like a block of wood; and in practice it has proved a miserable failure. The bone-setter, on the other hand, smashed down the arch of the foot, or, to put it less crudely, he restored its mobility, so that it could flatten without resistance and therefore without pain, and he cured his patients. Most appropriately my experience has led me to mention first the commonest use of manipulation in surgery. For foot strain (not flatfoot, if you please) is one of the commonest ailments of the human body. It may be postural or traumatic in origin. It can be cured by manipulation and in no other way. See to it that you cure it, or others will cure it for you, as they have done in the past.

Sacro-iliac strain is the commonest cause of persistent pain in the lower part of the back. It is a definite clinical entity, characterized by pain in the sacro-iliac joint, tenderness on pressure over the posterior superior spine of the ilium, a sense of insecurity or weakness, and, in most cases, a normal x-ray picture. So that with the simple precaution of a routine x-ray exam-

ination one can diagnose and treat a case of sacro-iliac strain without hesitation. We believe that sacro-iliac strain is a chronic strain or sprain with particular adhesions such as may occur in any other joint. Often there is a definite history of injury and the strain is common after childbirth, but sometimes it is of gradual onset and due to faulty posture. Over 90 percent of the cases can be cured by manipulation under an anesthetic followed by massage and exercises. Those which do not respond to manipulation can be cured outright by arthrodesis of the sacro-iliac joint.

Chronic lumbar back strain is perhaps the next most common cause of persistent pain in the back. It begins acutely with a sharp stabbing pain during some effort or awkward movement. It is due to rupture of some of the deeper fibers of the erector spinae muscle on one side or the other. When the condition becomes chronic there is a point of local tenderness over the erector spinae, spasm of the muscle resulting in limitation of movement, and often a considerable degree of neurosis. Practically all these cases can be cured by manipulation, unless there is an impending claim for compensation or a long-standing traumatic neurasthenia.

For many years bone-setters have claimed that they can cure cases of displaced semilunar cartilages by manipulation. It is not true; but here again we have learned something from the bone-setter. Chronic knee sprain can be cured by manipulation. In such cases the injury has stopped short of that gross injury which results in a torn cartilage and has produced instead a sprain of the peripheral attachment of the cartilage. When this condition becomes chronic, the patient complains of frequent stabbing pain on the inner side of the knee, occasional attacks of synovitis, and weakness of the joint. He may say that the knee gives way, or slips, or "goes out," but there is never any mechanical obstruction to movement. These cases are common enough; the symptoms of course are due to fibrosis or "adhesions" at the periphery of the cartilage and they can be cured by manipulation; and inasmuch as they are usually diagnosed as "slipped cartilage" by bone-setters and the public, they are largely responsible for the popular belief that displaced semilunar cartilages also can be cured by manipulation.

Gonorrhea in the Adult: Diagnosis; Elliott Treatment and Hyperpyrexia

By W. Spencer Gurnee, M.D.,; Assistant Visiting Gynecologist and Obstetrician, Bellevue Hospital, New York City; in Am. J. Surg., XXXIII:3:500, September 1936.

The general care of a gonorrhea which has not spread past the cervix includes bed rest at the menstrual periods and for two days following it, for this is the danger period when extension to the tubes is made more possible by the menstrual flow removing the cervical mucous plug. The diet does not need to be altered except to force fluids to encourage frequent urination. Alcoholic beverages are prohibited. Bowel hygiene should be paramount, a daily dose of milk of magnesia being generally sufficient.

Local Treatment. Scrupulous cleanliness of the genitalia is demanded. In the acute stage Sitz baths may be necessary to wash away pus that collects between labial folds. Vulval pads should be changed frequently. Paraurethral passages and vulvar crypts, as well as Bartholin's ducts, if infected, should be irrigated with acriflavine, using a blunt hypodermic needle.

Endocervicitis and Urethritis. Elliott treatments are given every day by means of a distensible rubber bag inserted into the vagina. Water at 115° F. is instilled through the tubing connected with the bag and allowed to increase 3/4° per minute until 128° is reached and is then maintained at that temperature for one hour. The heat radiates in all directions and the slow rise in the temperature allows the blood vessels to dilate and then contract thus overcoming the resulting hyperemia. The vagina tolerates more heat than the vulva or perineum, probably due to the absence of heat nerve innervation and to an abundant blood supply. The blood supply acts as a cooling system, rapidly carrying away the heat, yet during an Elliott treatment the temperature beside the bag is about 125° F., again the anterior rectum wall it is 106° F., the posterior wall 104.5° F., the urethral meatus 104° F., and at the intra-abdominal cul-de-sac it is 106° F.

As this type of heat is local in nature, only the inflamed part is within the area of hyperemia. The mouth temperature is rarely increased, which is unlike diathermy. In diathermy all the pelvic blood vessels are heated. This large cooling system immediately carries the heat to the lower extremities and to the trunk and soon they are almost the same temperature as the pelvis, but only 1° or 2° increase. The interior of a piece of meat or a loaf of bread can be shown to be cooked by diathermy, but if a cooling system were inserted it would not be so. Diathermy is excellent for prolonged treatments, but for short one-half hour treatments, we do not believe the temperature is raised sufficiently.

After each daily Elliott treatment, a long virginal speculum is inserted into the vagina, which is cleansed with acriflavine, wiped dry and a spread taken from the endocervix.

Short-wave diathermy, the newer method of heat therapy, is administered by the same technique as the old diathermy; i.e., by a vaginal pole and an indifferent pad placed over the abdomen. The treatments may also be given with a pad front and back or side to side, but by this method much heat is lost and the pelvic temperature which is attained is not sufficiently high. The great disadvantages of the short-wave therapy are two: (1) it heats the entire pelvis and therefore gives a generalized body temperature causing perspiration and discomfort, and (2) these treatments may be followed by severe electrical burns which are often quite deep.

Artificial fever produced by the hot box, as fashioned after that of Carpenter and Warren of Rochester, New York, became very popular in 1934. We used it for one year, treating 27 patients following the technique as described by its originators. One of these patients died from heat stroke, and two others had very severe heat strokes with deep burns that necessitated skin grafting.

Therefore we concluded that hyperpyrexia sustained for six hours at 106.8° F. was a very severe treatment to obtain a 55 percent chance of curing gonorrhea in the female. We could not understand how patients of other clinics would tolerate several sessions of this type of fever therapy to effect cures or how some clinics gave less heat for shorter intervals and reported cures. We believed, however, that heat was the proper means with which to attack gonorrhea and tried to perfect a technique which would eliminate the generalized dangers and discomforts.

In order to eliminate the risks reported, we wanted a treatment which would give a high pelvic temperature

to kill the gonococci and a low cerebral temperature which would not kill the patient or even worry the doctor in attendance. To obtain this happy medium, we gave a hot box treatment, but kept the mouth temperature at 105° F., and at the same time ran a continuous Elliott treatment with the water in the vaginal bag at 115° to 118° F. By this method we obtained higher rectal temperatures than by the hot box alone and the patient's general condition was never a cause for alarm after the first hour. In fact, for most of these cases, no doctor sat with the patient continuously as had to be done with the hot box alone, their care being left to the nurse who called the doctor if the patient seemed in distress. No case treated with the hot box and Elliott treatments developed any severe complications or was ever in danger, and we feel that the treatment is safe under the care of a trained nurse.

Thirty patients treated by this combination had a total of 56 treatments; six had only one treatment with one cure, while 19 patients had two treatments with five failures, or 74 percent cures; and correcting this figure because two of the failures were at the beginning of the experimentation and had lower mouth temperatures than the regulation 105° F., the percentage of the cures would be 82.4 percent for two treatments. Two patients submitted to a third treatment after not being cured by a second, and one patient was cured. Only one patient would brave a fourth treatment, but it finally cured her.

Comment

Hyperpyrexia produced by the hot box combination with short-wave therapy has taken an insiduously dangerous aspect since the development of two cases of vesicovaginal fistulas, and so we will discontinue this combination for the time being, relying on the combination of hot box and Elliott treatment which gives satisfactory results without complicating dangers.

Colonic Irrigation

By Frank Hammond Krusen, M. D., Rochester, Minn.; in the J. A. M. A., 106:2:119, January 11, 1936.

I thoroughly agree with Bastedo on this point, and feel that if colonic irrigations should be indicated, the tube should not be introduced for more than 4 to 6 inches (10 to 15 cm.). The myth of the so-called high colonic irrigation has thus been exploded, and this term should be abandoned.

In the few cases in which colonic irrigation may be indicated it is probably best to follow one of the two methods described by Bastedo as follows:

The One-Tube Method—This involves filling the colon to capacity through a single tube and then allowing the liquid to run out through the same tube, the process being repeated a number of times. The tube most favored is velvet-eyed with closed end, number 34 French, and is inserted about six inches. As demonstrated by roentgenograms, when the ordinary colon tube is passed beyond six or eight inches, it coils in the upper rectum and, no matter how much of the tube is inserted, it rarely enters the descending colon. There is therefore no benefit to be derived from passing a long colon tube 18 or 20 inches to form such a coil in the rectal ampulla.

The Two-Tube Method—This employs separate inflow and outflow tubes. . . . . For the inflow I use a soft rubber velvet-eyed catheter, number 20 to 24 French, inserted from 5 to 6 inches, and for the outflow, a velvet-eyed closed-end rectal tube (or stomach tube), number 30 or 32 French, inserted from 3 to 4 inches.

Bastedo listed the following instructions for the nurse-technician administering the irrigation:

1. If the patient has not defecated, empty the bowels with a plain water enema and wait fifteen minutes for the defecation reflexes to quiet down.
2. For the first gallon have the patient lie on the left side with the knees drawn up. After that have the patient lie on the back.
3. Hang the reservoir so that its midlevel is not more than two feet above the rectum.
4. Having freely lubricated the tubes with white petrolatum, have the patient bear down as at stool and insert the inlet tube five or six inches, allowing the water to flow during its insertion. Then insert the outlet tube three or four inches.
5. Use plain water at or just above body temperature, and let it run slowly to avoid arousing the defecation reflexes.
6. If the outlet tube becomes plugged, inject a little water through it with a hand bulb. If this does not clear it, withdraw it without disturbing the inlet tube, clean it and reinsert.
7. Terminate the irrigation when convinced that the colon is clean or when you think the treatment has been sufficiently prolonged. We expect an irrigation to consume from six to ten gallons and to take nearly an hour.
8. After the irrigation, have the patient empty the bowels into the toilet. Examine this return before the toilet is flushed.
9. Report particularly on the various odors and on the amount and character of the mucus, feces and recognizable food particles in each gallon of the return.

Ordinary tap water or physiologic solution of sodium chloride at body temperature is probably more satisfactory. If colonic irrigation is to be used, the latter is recommended in preference to antiseptic solutions. The use of very hot solutions to destroy intestinal parasites is of very doubtful value.

Equipment

Still another phase of the "racket" indulged in by certain lay charlatans in the field is the manufacture of elaborate devices for the administration of colonic irrigations. These machines are part and parcel of the systematized skullduggery practiced by this not inconsiderate group of quacks. These devices usually have one or more adjustable irrigation tanks attached to a table, equipped with various gadgets to make it appear imposing. There may be a built-in hopper, and an elaborate system of petcocks, water connections, flushing devices, solution warmers, or tube sterilizers, all as a rule finished off with an imposing amount of shining chromium. It is interesting to note that, strangely enough, there have been and are being issued innumerable patents by the United States Patent Office for these devices.

I must confess to having succumbed to the temptation to purchase one such attractive machine for a hospital department under my supervision, during the predepression era. Many times thereafter I wished that I might have had the money, thus unwisely spent, for other purposes. For I soon found that the apparatus was in little demand and that the work could be done just as easily with (1) an ordinary treatment table, (2) a plain glass irrigation jar on a stand, (3) a rectal tube and a Y-tube with two clamps, and (4) a large closed jar or an ordinary hopper to receive the return flow. If,

therefore, colonic irrigations are to be given at all, the latter simple arrangement is recommended.

Summary

The colonic irrigation is not to be considered as a massive enema but as a lavage of the colon above the area of defecation, administered under low pressure so that the defecation reflex is not stimulated. One must also consider that in conjunction with the lavage there are possibly other factors present (such as pressure, temperature, motion and osmosis) which may act to influence normal and disturbed physiologic processes in the gastro-intestinal tract. Copious amounts of fluid are usually employed. Antiseptic solutions or solutions which tend to acidify or alkalinize the colonic contents are of little or no value. Tap water or physiologic solution of sodium chloride seem, as a rule, more satisfactory.

The term "high colonic irrigation" should be abandoned. The attempt to introduce a long stiff tube into the cecum is dangerous and usually fails, the tube coiling in the rectum. If the tube is introduced only three or four inches, under ordinary conditions the fluid will reach the cecum in from two to five minutes anyway.

Elaborate apparatus is not necessary for the administration of colonic irrigations.

Colonic irrigations have been greatly exploited by charlatans, ignorant persons and, most unfortunately of all, by men within the medical profession.

The oft-repeated or routine administration of colonic irrigation is to be strongly deprecated.

Whereas an occasional series of colonic irrigations may be indicated for the treatment of unfavorable conditions within the intestinal canal, as for example at times in arthritis, or for the removal of retained fecal material from the colon, such indications are relatively infrequent.

How Arteries Compensate for Occlusion

An Arteriographic Study of Collateral Circulation

Edgar V. Allen, M. D., Rochester, Minn., in Arch. Int. Med., 57:3:601, March 1936.

Comment

It is obvious from this study that collateral circulation is profuse in cases of occlusive arterial disease. Logical and purposeful design in the development of collateral circulation is apparent, for without the ability to develop collateral circulation the integrity of limbs would be seriously endangered by comparatively minor degrees of arterial occlusion. It is of interest that the methods by which embarrassment of the circulation resulting from arterial occlusion is overcome in the extremity are about the same as those which an engineer would use to surmount similar obstacles in hydrodynamics. If a segment of a stream was occluded by a dam which could not be removed, what would be more logical than the construction of a canal around the dam, thus reestablishing the continuity of the stream. Or if one of two parallel canals was irremediably destroyed, how could the problem be better solved than by sending branches out laterally from the unoccluded canal to the area which ordinarily was supplied by the one which was destroyed. For every method of overcoming arterial occlusion, as seen in the arteriogram, there exists a logical parallel procedure to overcome a similar obstacle in hydrodynamics.

Neither this observation nor Hunter's statement that "the blood goes where it is needed" satisfactorily answers questions about the origin of collateral circulation. How do collateral arteries develop? Are they constructed anatomically in situ, or do they represent increased function in arteries which already exist? A somewhat analogous situation exists in the glomeruli of the kidney—only a small percentage of these function at any time.

Contrast of the arteriograms of normal limbs of the living subject with the arteriograms of limbs which have been amputated for reasons other than arterial disease reveals marked differences. In the latter condition the number of arterial branches and the surface area which is occupied by the arteries are much greater than those which are seen in arteriograms of normal living subjects. This is evidence that a great many arterial branches which are not visible in the arteriogram of living subjects exist nevertheless. This failure to render many existing arteries visible in the arteriograms of living subjects is apparently not a defect of the method; these arteries apparently are not functioning. Further evidence for this assumption is offered by the experimental work of Horton and Craig, who made arteriograms of the hindlegs of dogs, on some of which a sympathectomy had been performed. The surface area which was occupied by arteries was much greater in the limbs in which sympathetic denervation had been performed than it was in the normal control limbs. It is a common observation that blocking of the sympathetic impulses to an extremity by anesthesia or by operation leads to an immediate and sharp increase in the temperature of the part, a manifestation of increased circulation. This is almost certain evidence of increased function of the arteries which existed in a partial or complete resting state before the interruption of the sympathetic impulses was effected.

Mulvihill and Harvey have demonstrated that after ligation of the external iliac artery the temperature of the leg of a dog drops rapidly to the level of the temperature of the room. After a few hours the temperature rises rather abruptly to that of the control limb. Further experiments demonstrated that if a sympathectomy was performed before ligation of the artery no decrease in the temperature occurred when ligation was performed, and if a sympathectomy was performed when the temperature was low, as a result of ligation of the artery, the extremity immediately became as warm as the normal member. These experiments offer convincing evidence of the major role of the vasomotor component in establishing collateral circulation, and when considered with other data which have been presented briefly in the preceding paragraphs, they indicate that, in the main, collateral arteries which are seen in the arteriograms of living subjects who have thrombo-angiitis obliterans are arteries which were present before the onset of the arterial disease. The function and hence the size of these arteries was increased, apparently to compensate for occlusion in the main arteries.

Summary

Collateral circulation may be very profuse in cases of thrombo-angiitis obliterans. By methods which have been designated as anastomosis, lateral projection, prolongation, terminal branching and network formation, a collateral circulation develops which can compensate for extensive occlusion of the chief arteries of an extremity. There is indirect but entirely logical and convincing evidence that collateral arteries are chiefly arteries which are present normally but which have increased in size as a response to a demand for increased function which arises as a result of occlusion of the main arteries.

Traumatic Oedema

A Pitfall in Physical Medicine

By L. C. Hill, M.D., M.R.C.P., Honorary Physician to the Devonshire Royal Hospital, Buxton; in British M. J., No. 3951, Sept. 26, 1936, page 623.

Physical therapy, largely on account of its unique flexibility of application, has at last received tardy recognition, and now takes its place as an important branch of medical treatment. There are, however, certain disease processes which at first sight would appear of the type likely to benefit from such methods but which fail to respond as expected. I have recently encountered in hospital and private practice such a group, and after floundering in a state of considerable uncertainty for some time I arrived at certain conclusions regarding their appropriate treatment as a result of the experience thus obtained.

To those whose work brings them into regular contact with industrial compensation cases, the development of oedema after injury to an extremity offers great difficulty, and it is important that the peculiar problems of true traumatic oedema in regard to its treatment, expected course, and prognosis should be fully understood. My main object has been to discuss the various methods of treatment and their influence upon the development and prognosis of the disease.

There are three main theories with regard to the production of traumatic oedema as the condition is thought to result from changes in the circulatory, lymphatic, or sympathetic nervous systems. Whatever the cause of the retention of fluid in the tissues, the distension produced may ultimately lead to a proliferative reaction in the connective tissues and result in diffuse fibrosis which shows itself mainly as a permanent periarticular thickening with a consequent hampering effect on movement.

Venous stasis, which is an accepted cause of oedema, may result from the blocking of a vein, as in phlebitis, vaso-dilation or vaso-constriction. By means of local thermometry, Braeucker showed that the circulatory disturbance is localized in the region of the arteriolocapillary network, manifesting itself by wide and frequent alterations in the skin temperature. Unfortunately, pathological examinations have not assisted in establishing the culpability of the circulatory system, since organic changes in the vascular walls have been found in only a fraction of the cases investigated. There is much evidence to show that traumatic oedema cannot be due to circulatory effects alone, and it may be summarized as follows:

1. Leriche showed in a case of oedema that section of a venous cord blocked by phlebitis, which could not therefore influence the circulation, caused disappearance of the oedema. (The effect of this operation is that of a true sympathectomy.)

2. Methods aimed at improving the circulation by direct action upon the vessels are useless.

3. Ranvier tied the inferior vena cava of a dog below the level of the right ventricle and then cut the sciatic nerve. As a result, gross oedema developed on the affected side. When the sciatic nerve was cut below the point where its fibers enter the vessel wall there was no oedema.

4. Leriche, in ten instances, tied three veins in a rabbit's ear without producing oedema. If, however, a cervical sympathectomy were done at the same time, oedema resulted.

The theory that lymphostasis is to blame in traumatic oedema is supported by Basset, Hagenau, and Gemthrou, who came to this conclusion after failing to obtain satisfactory results by operative measures.

The Sympathetic Nervous Theory

Leriche may be truly described as the greatest exponent of this theory, and his published figures are very striking; Telford and Stopford in this country and others have also worked on this problem. Brandao describes a series of operations on the upper limb which produced exactly similar results. He began with a sympathectomy, the immediate result of which was disappearance of oedema and pain, but at the end of ten days the condition reasserted itself. The next step was the removal of the stellate ganglion. Again the relief was immediate, this time lasting for three months, after which the swelling returned, but to a diminished extent, and it did not extend above the wrist. Lastly, he removed the whole of the cervical sympathetic system, with the result that the oedema once again disappeared and had not returned in any of his patients at the time of publication of the article, a period varying between one and a half and two and a half years after the operation.

Symptoms and Signs

The initial trauma is usually, but not necessarily, severe. Three of the present series were associated with fractures and gross injury; the fourth followed after a sprain of the wrist. Pain is always present. It diminishes in severity in proportion as the tissues recover from the effects of the original injury.

The primary swelling is soft, pits on pressure, and tends to diminish rapidly with the preliminary measures of rest, especially in plaster. The skin shows little abnormal change; it varies in color but is usually pale; it may be moist and its temperature is normal. Trophic changes are not present in the nails. The secondary swelling or true traumatic oedema appears at the end of two or three weeks and is hard and brawny in character. The skin is now usually cyanosed, cold to the touch, and possesses the glossy appearance associated with trophic changes. The nails become grooved and brittle.

Physical Therapy and Mobilization

With regard to the value of physical therapy in the treatment of traumatic oedema, the opinions of other workers are in close accord with my own experience. Generally speaking, at all stages of the disease it is likely to do more harm than good. Occasionally in the later stages, when the morale of the patient has been undermined by the prolonged period of incapacity, physical therapy may act as a stimulant and so have a useful psychological value. In particular, massage, passive movements, douches, and baths are dangerous, and if persisted in will bring about an increase not only in the oedema but also in the subjective discomfort of the unfortunate patient. A certain amount of active movement of fingers or toes may be permitted even in the early stages (this is quite consistent with immobilization in plaster), and in the later stages, when not associated with pain, active movements may lead up to the provision of suitable light work. Early mobilization of fractures and severe sprains is responsible for the development of traumatic oedema in the majority of patients.

Immobilization

This is the method of choice, and it must be early, complete, and accompanied by elevation of the limb. It

is not within the province of this article to deal at length with the treatment of fractures by immobilization in plaster with provision (consistent with complete immobilization at the site of the fracture) for finger or toe movements, and permission even for gentle use of the limb; such treatment would prevent many cases of traumatic oedema. When, in spite of these precautions, oedema appears or fails to disappear, then complete immobilization of the whole limb with elevation is essential for at least one month. At the end of this time the plaster may be bivalved and, if the oedema is diminishing and the pain has disappeared, removed for a few minutes daily for gentle active movements. These may be carried out with great advantage in a bath of about 99° F. At least a fortnight should elapse before greater activity is permitted. Afterwards the length of time for which the plaster is removed may be progressively increased.

Conclusions

1. Traumatic oedema is a specific affection of an extremity coming on several days after trauma, which is usually, but not always, of a severe character. It consists of a distension of the part with lymph following a dislocation of the normal fluid interchange in the tissues. Experimental evidence and a consensus of opinion suggests that changes in the lymphatic rather than the circulatory systems are responsible. Its persistence is due to the development of abnormal influences from the higher sympathetic centers which prevent the re-establishment locally of the normal equilibrium.

2. The majority of cases can be prevented by the correct treatment of fractures as described elsewhere, and by the avoidance of early mobilization.

3. In an established case, early immobilization with elevation and complete rest will not only greatly curtail the period of incapacity but will prevent the resultant fibrosis.

4. The application of physical therapy at any period other than in the very late stages is unjustifiable.

5. Operation in certain hands offers great advantages when the condition is established, since it not only cuts short an otherwise protracted course, but if carried out at an early stage prevents the development of fibrosis. It would appear that both periarterial sympathectomy and removal of the corresponding portion of the higher sympathetic system is required for a permanent cure.

6. Uneven osteoporosis is the characteristic x-ray appearance with, in the later stages, periarticular thickening.

Sprains and Allied Injuries

By R. O. Emslie, M. S., F. R. C. S., Orthopedic Surgeon to St. Bartholomew's Hospital; in the Clin. J., LXV: 10:395, October 1936.

I come now to the more ordinary and straightforward cases of sprains—those in which a ligament has been damaged but the stability of the joint not affected, those in which a tendon or muscle has had a few fibers ruptured, either in its course or at its origin or insertion. In these cases early use is an important point in the treatment. The first thing to do if they are seen early is to try to limit effusion. The most effective way is by using a compression bandage, wrapping the part up in a considerable thickness of cottonwool and bandaging over this with a domette or crepe bandage as firmly as possible, the bandage not being allowed to extend beyond the wool. Some patients will not put up with this type of bandage, and it is then necessary to use an evaporating lotion instead. After the first 24 hours an attempt should be made to bring the part into use with sufficient support. In most cases the application of elastoplast or adhesive strapping is the best method. In many cases of sprain of the ankle, elastoplast can be applied from the middle of the foot up to the lower part of the calf after 24 hours, and the patient can be induced to start walking. If possible he should put on a shoe, as walking is much easier with a shoe than without. In the case of partial rupture of the calf muscle, the calf should be strapped and the patient made to walk, putting his heel on the ground as early as possible. The same method of strapping and use applies to sprains of muscles in other situations and to sprains of the wrist.

Massage may be begun quite early, but at first it should be gentle and aim simply at getting rid of effusion, and the movements should be those that the patient can be persuaded to do of his own accord. To knead deeply over an injured area is only to increase the effusion, and forced movements in the early stages is almost equivalent to tearing open a surface wound when it is just healing. Sometimes with a nervous patient it is difficult to get active movements carried out, and the use of a faradic battery applied gently to the muscles concerned will help to get up some small movement. In carrying out massage of an injured limb Dr. Mennell has forcibly put a very important principle. He says that "you should first uncork the bottle before you try to empty it." In other words, if you have swelling and effusion around the ankle, you should start your massage higher up the limb first, so as to make sure that you can reduce the effusion from below. The most important item in physical treatment is the restoration of full movement and of complete function. Many sprains continue to give trouble later on simply because the movements of the muscles or joints concerned have been left with some slight restriction. Physical exercises, therefore, should be continued until movements are as full as they are on the sound limb without producing any discomfort, and until the part can be used in a perfectly normal way.

Intermittent Venous Compression in Treatment of Peripheral Vascular Disease

Abst. in Jour. A. M. A., 107:9:743, Aug. 29, 1936, from Am. Heart J., 11:705, June 1936.

Collens and Wilensky endeavored to incorporate the beneficial effects of venous obstruction and release in the treatment of peripheral vascular disease by utilizing an apparatus designed to produce alternating periods of venous congestion and release of congestion. Sustained venous compression at from 30 to 60 millimeters of mercury for two minutes followed by a release of this pressure for another two minutes resulted in clinical benefits. The technic consisted of applying venous compression at the midthigh, alternating with release in periods of two minutes for as long as twelve hours continuously each day. The criteria employed in determining the effectiveness of treatment consisted of (1) a walking test, (2) a hot water immersion test (Landis), (3) oscillometric readings, (4) relief of pain, (5) healing of ulcers, and (6) effect of treatment on skin temperature. Following treatment there was relief of pain, increase of skin temperature of the extremity, increase in walking efficiency, increase in vascularity (permitting amputation at lower levels), and healing of chronic indolent ulcers associated with vascular obstruction.

Book Reviews

RESIDUAL NEUROMUSCULAR HYPERTENSION. By Josephine L. Rathbone, M. A., Instructor in Physical Education, Teachers College, Columbia University. Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Philosophy, Columbia University. Paper. Price, $2.00. *Pp.* 220. *New York, The Author,* 1936.

This monograph gives an excellent discussion on fatigue and residual neuromuscular hypertension. Chapter I is devoted to a discussion of the various forms of fatigue. Chapter II gives the outstanding contributions of sociologists, industrialists, physiologists, psychologists, psychiatrists and other clinicians to the problems of fatigue. Chapters III and IV deal with the physiology of the neuromuscular system particularly in its relation to residual neuromuscular hypertension. Chapter V gives possible causes of this tension with illustrative cases from clinical records, and Chapter VI gives recommendations to reduce this tension during the school life of individuals and thus also to reduce it in adult life.

In the recommendations for the reduction of neuromuscular hypertension, Rathbone emphasizes the need of more than a hasty medical examination at school health inspections and also a better school health service.

In the discussion of physical education activities to avoid this tension, the author suggests that a school child, who is required to maintain static postures for long periods of time, should have extensive and rhythmic movements for physical exercise. Many of the illustrative cases showed faulty chest development and extreme residual tension in the diaphragm. Therefore it is logical to place special emphasis upon proper development of the chest. The danger of "overtraining" in athletics is emphasized. In posture work it is noted that all held positions are fatiguing. From a study of certain illustrative cases it appears particularly desirable that no efforts shall be made in physical education to encourage the absolutely flat lower back which introduces disturbing contractions in numerous muscles. The above discussions and suggestions merely indicate the value of this monograph. The subject of fatigue is most important and this volume should be read by every physical educator and physical therapist.

DIGESTION AND HEALTH. By Walter B. Cannon, George Higginson Professor of Physiology, Harvard Medical School. Cloth. Price, $2.00. *Pp.* 160 *with* 14 *illustrations. New York, W. W. Norton & Company, Inc.,* 1936.

Bodily health depends, among other factors, on the proper use of the food we eat. The author of this volume is an international authority on physiology, and here relates in simple language the relation of digestion to health. There are chapters on the nature of appetite and hunger; the nature of thirst; digestion and bodily vigor; and indigestion from pain, worry and excitement. The author relates in an interesting manner how questions arose about these subjects, how ideas to solve them developed and how the investigations suggested by the ideas were performed in physiology laboratories. These researches show the conditions favorable and unfavorable to the use of food by the body. It is a book that can be recommended to anyone interested in these subjects.

NEUROLOGIC SURGERY. By Loyal Davis, M. S., M. D., Ph. D., D. Sc. (Hon.), Professor of Surgery and Chairman of the Division of Surgery, Northwestern University Medical School, Chicago, Illinois. Cloth. Price, $6.00. Pp. 416 with 174 illustrations. Philadelphia, Lea & Febiger, 1936.

In the preface to this compact volume the author makes a point of the fact that neurolgy and its surgical aspects has always been regarded both by physicians and students of medicine as an extremely difficult and complex subject. To be sure, the study of the nervous system is far from simple, yet from a practical standpoint it may be presented in a way so as to be adequately comprehended by the average practitioner.

The first part of the book deals briefly with applied anatomy of the nervous system in which motion, sensation, reflexes, cranial nerves, cerebrum and cerebellum are presented in concise and simple description. The author then deals with the more common neurosurgical problems, such as cranio-cerebral injuries, intracranial tumors and abscesses, trigeminal neuralgia, and facial palsy. Injuries, tumors and abscesses of the spinal cord are discussed briefly and clearly. Perhaps the best chapter in the book is that on injuries of the peripheral nerves,—a subject in which the author has done considerable excellent research. A chapter dealing with the surgery of the autonomic nervous system is particularly timely and reveals the author as a conservative exponent of sympathectomy and its allied procedures. The surgical treatment of convulsions as presented will also be of general interest.

The purpose of this volume is primarily to call to the attention of the physician those neurologic conditions commonly met with in practice which should be recognized promptly as problems which require the special treatment of the neurologic surgeon.

THE DELINQUENT BOY AND THE CORRECTIONAL SCHOOL. By Norman Fenton, Director of the California Bureau of Juvenile Research. With the collaboration of Jessie C. Fenton, Margaret E. Murray, and Dorothy K. Tyson, Psychologist, Whittier State School. Paper. Price, $1.50. *Pp.* 182 *with* 8 *illustrations. Claremont, California: Claremont Colleges Guidance Center,* 1935.

This volume is a report of the work being done at the Whittier State School of California where Norman Fenton and his associates have performed a "noble experiment" with delinquent boys. Acting upon the theory that the child in the juvenile court is not to be considered as a criminal before the bar of justice but rather as a subject for study and guidance, this modern correctional school has set a splendid example for intelligent treatment of a difficult social problem. Each of the 400 boys under supervision is studied individually as to the factors precipitating his delinquency. Educational, vocational, religious, and recreational guidance under competent leadership is carried on so as to help restore the growing child to society as an honest and useful citizen.

Although much excellent work is being accomplished, the author and his associates plead for assistance from the psychologist, physician, psychiatrist, educator, and social worker to improve our present methods of preventing and correcting these behavior problems of youth.

A TEXTBOOK OF PHYSIOLOGY FOR MEDICAL STUDENTS AND PHYSICIANS. By William H. Howell, Ph. D., M. S., Sc. S., LL. D., Emeritus Professor of Physiology in the Johns Hopkins University, Baltimore. Thirteenth edition. Thoroughly revised. Cloth. Price, $9.00. Pp. 1150 with 308 illustrations. Philadelphia and London: W. B. Saunders Co., 1936.

The author has kept in mind two guiding principles: first, the importance of simplicity and lucidity in the presentation of facts and theories; and second, the need of a judicious limitation of the material selected. There is a bewildering number of researches published or being published in the field of physiology and the closely related sciences. It is difficult to justly estimate the value of conflicting results and one is frequently forced to be satisfied with a suspension of judgment. The writer who attempts to formulate our present knowledge upon almost any part of the subject is in many instances obliged to present the literature as it exists and let the reader make his own deductions. This is undoubtedly the most satisfactory method for the specialist and advanced students but for the beginner it is absolutely necessary to follow a different plan.

The author has selected his material for presentation by the process of elimination rather than a process of condensation. During recent years chemical work in the fields of digestion and nutrition has been very full and this has subjected older theories to severe criticism. Important advances in theoretical chemistry and physics have greatly modified the attitude and point of view in physiology. In all this new work the author has clearly endeavored to show the possible tendencies of the time. The author shows that physiology is a growing subject continually adjusting its theories. The writer has taken into consideration the growing field of biochemistry.

The content of this volume is divided into nine sections dealing with physiology of nerve and muscle, of the central nervous system, of the special senses, of the organs of circulation of the blood and lymph, of respiration, of digestion and secretion, of nutrition and heat production and regulation, and of reproduction. There is in addition a valuable appendix on proteins and their classification, diffusion and osmosis, and a table showing distribution of vitamins in foods.

It is an up-to-date presentation of physiology, a excellent book not only for the medical student but als for the busy practitioner who wishes to keep pace wit the modern trends in physiology. It will make an ex cellent addition to the library of the physical therapi who desires to keep abreast with changing theories i this field as well as serving as an excellent textbook fo courses in physical therapy. Its scientific accuracy ha not suffered from the author's simplicity of presentation

THE PATIENT AND THE WEATHER. By William F. Petersen, Professor of Pathology and Bacteriology, University of Illinois, College of Medicine with the assistance of Margaret E. Milliken, S. M. Vol. 1, Part 2. "Autonomic Integration." Cloth. Price, $9.00. Pp. 781 with 366 illustrations. Ann Arbor, Edwards Brothers, Inc., 1936.

This volume of the series of monographs entitled "The Patient and the Weather" is profusely illustrated and discusses the constitution of the body and the limitations of cellular response of the individual. In considering atmospheric environment, the cyclonic circulation, atmospheric pressure, temperature, humidity, sunlight, atmospheric electricity, and ionization are discussed in detail. An excellent bibliography is given at the end of each section. These sections have a direct interest to physical therapists as they make obvious the close integration of the human organism and the immediate atmospheric environment.

The author states that in its simplest analysis he can summarize the contents of this particular volume with the statement that the organism adjusts to the meteorological environment by the three major components of the autonomic apparatus—chemical, endocrine, and nervous. The main part of this volume is devoted to studies of these adjustments, in normal individuals living in the midst of the storm tracks.

Many physical agents are used to counteract the effects of the weather on the patient. The use of local and general heat in chronic arthritis is an illustration. Likewise general ultraviolet radiation is used to overcome the lack of this radiation in the winter months. Therefore, this volume is recommended as a reference book to physical therapists doing research.

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